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NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY. APPENDIX O. FISH--ETC(U)

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North Atlantic Regional Water Resources Study

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Appendix O

Fish and Wildlife

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY COORDINATING COMMITTEE

MAY 1972

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The North Atlantic Regional Water Resources (NAR) Study examined a wide variety of water and related land resources, needs and devices in formulating a broad, coordinated program to guide future resource development and management in the North Atlantic Region. The Study was authorized by the 1965 Water Resources Planning Act (PL 89-80) and the 1965 Flood Control Act (PL 89-298), and carried out under guidelines set by the Water Resources Council.

The recommended program and alternatives developed for the North Atlantic Region were prepared under the direction of the NAR Study Coordinating Committee, a partnership of resource planners representing some 25 Federal, regional and State agencies. The NAR Study Report presents this program and the alternatives as a framework for future action based on a planning period running through 2020, with bench mark planning years of 1980 and 2000.

The planning partners focused on three major objectives -- National Income, Regional Development and Environmental Quality -- in developing and documenting the information which decision-makers will need for managing water and related land resources in the interest of the people of the North Atlantic Region.

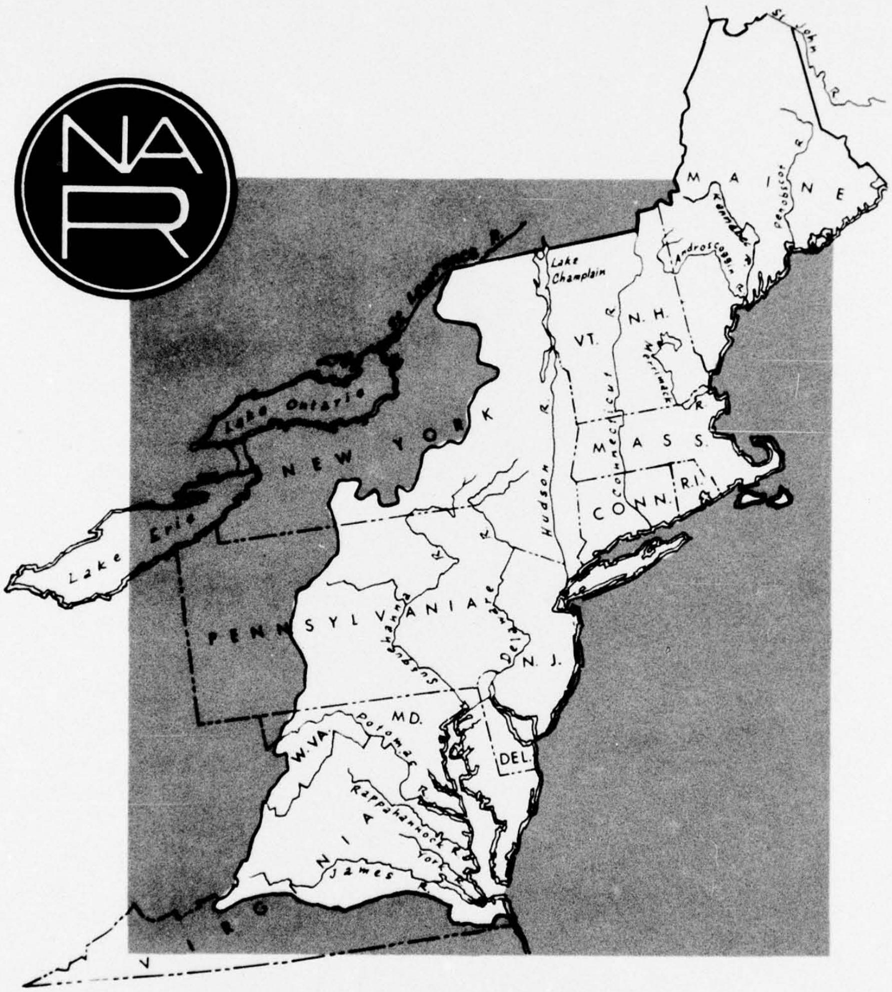
In addition to the NAR Study Main Report and Annexes, there are the following 22 Appendices:

A. History of Study
B. Economic Base
C. Climate, Meteorology and Hydrology
D. Geology and Ground Water
E. Flood Damage Reduction and Water Management for Major Rivers and Coastal Areas
F. Upstream Flood Prevention and Water Management
G. Land Use and Management
H. Minerals
I. Irrigation
J. Land Drainage
K. Navigation
L. Water Quality and Pollution
M. Outdoor Recreation
N. Visual and Cultural Environment
O. Fish and Wildlife
P. Power
Q. Erosion and Sedimentation
R. Water Supply
S. Legal and Institutional Environment
T. Plan Formulation
U. Coastal and Estuarine Areas
V. Health Aspects

WATER RESOURCES NEEDS AND POTENTIALS FOR AN EXPANDING SOCIETY

069170

Appendix O
Fish and Wildlife



Prepared by

Bureau of Sport Fisheries and Wildlife
Fish and Wildlife Service
United States Department of the Interior

for the

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY
COORDINATING COMMITTEE

PREFACE

This report on fish and wildlife resources is a contribution to the comprehensive survey of water and related land resources in the North Atlantic Region, which was authorized by Congress in Section 208, Public Law 89-298. It culminates efforts to assess (1) the abundance and distribution of fish and wildlife resources, (2) the rate of present and future utilization, (3) their capability for meeting future needs, and (4) the economic impact these resources exert on the Region's economy.

The Bureau of Sport Fisheries and Wildlife participated in the study under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), as did the Bureau of Commercial Fisheries (now the National Marine Fisheries Service) and the state agencies having responsibility for fish and wildlife resources in the North Atlantic Region.

The North Atlantic Regional Water Resources Study will identify the problems in meeting the present and future needs of people. It will indicate their magnitude and establish priorities for developments to meet them.

More precisely, the objectives of the framework study are "the determinations in broad terms of overall basin requirements for water and related land resource development for municipal, industrial, and agricultural water supply, water quality control, flood control, and drainage, hydroelectric power; navigation; watershed protection and management, outdoor recreation, fish and wildlife conservation, and other purposes, the determination of the availability of water, the appraisal of the capability of the going program of resource development to meet indicated present and prospective needs; the formulation in general terms of a plan of development, including the indication of elements which would be required in the near future and the need for and priority of more detailed studies of tributary basin areas."

The North Atlantic Region includes all or portions of 13 states lying on the North Atlantic slope from Maine to North Carolina. It also includes, for the purpose of this study, the estuarine areas. These may be defined as those portions of the adjacent marine environment which are modified by the fresh-water run-off from the uplands and thus subject to modification by any extensive manipulation of the fresh-water component.

This Appendix presents a program to maintain and provide adequate fish and wildlife habitat to meet the needs of the people of the North Atlantic Region through the year 2020. It is admittedly based upon "broad-brush" quantification, insofar as possible,

of recreational activities dependent on fish and wildlife resources and description of the magnitude of the problems limiting fish and wildlife in a particular area, with subsequent formulation of possible solutions that would provide an adequate resource supply.

This Appendix should be useful for future studies of a more specific nature. The adoption of the solutions advocated in this report will benefit fish and wildlife resources and in turn the people of the Region.

SYLLABUS

FINDINGS AND CONCLUSIONS

The 2.4 million acres of streams, lakes and impoundments within the North Atlantic Region are capable of satisfying 108 million man-days of use provided public access is secured to this habitat. Although the on-going programs for access acquisition are attempting to provide for the recreational fishing requirements, these programs are inadequate to keep abreast of the rapidly growing demands. It will, therefore, be necessary to substantially augment these on-going programs.

It would appear that the foregoing developable capability would be sufficient to provide for the demands of the fresh-water fishermen through the year 2020. Such, however, is not the case. This is because fishing pressure is not distributed equally among the fishery resource types (e.g. cold-water and warm-water streams, cold-water and warm-water lakes). Increased habitat is, therefore, required by the year 2000.

The re-establishment of migratory runs of anadromous fish to their former spawning grounds has long been recognized as a great potential addition to the Region's sport and commercial fisheries. Although on-going programs have tended to reduce the discrepancy between supply and demand, these programs also are not adequate to provide for the total needs. Augmentation of existing programs is, therefore, required. Alleviation of pollution, incorporation of fish passage facilities, removal of obsolete dams, regulation of stream flows, provisions for fishermen access facilities, improvement of habitat, construction of fish hatcheries, and stocking programs will all require acceleration.

The developable capability of the salt-water sport fishery is considered adequate to support the demands through the year 2020. Augmenting on-going access programs will, therefore, provide sufficient opportunity.

The on-going programs of the estuarine-dependent commercial fishery are considered inadequate. The supply of edible finfish will be adequate through the year 1980, industrial fish and presently being overharvested. The shellfish supply will also be deficient by the year 1980 and even the supply of seaworms will be inadequate by the year 2000.

The capability of the commercial fishery resource can be increased by augmenting the on-going programs. Pollution abatement, appropriate legislation, and effective management of resources would enable the industrial fish and seaworm supply to meet the

demands through the year 2020. The supplies of edible fish and shellfish would also be increased and would be adequate through the year 2000.

The present capability of game resources to meet needs in the NAR (in man-days) is big game, 11.6 million; small game, 30.3 million; and waterfowl, 1.6 million. Although on-going programs are conserving and developing these resources, these programs will be insufficient in the face of mounting demands. Lack of public access in addition to destruction or alteration of wildlife habitat are primary reasons for this insufficiency. Because of these factors it is estimated that the capability of game resources by the year 2020 will be big game, 11.7; small game, 23.2; and waterfowl, 0.9 million man-days. Thus, small game and waterfowl capabilities are expected to be greatly reduced.

Because of a generally decreasing resource base and an increasing demand, the rate of needs is correspondingly increasing. It will be necessary to substantially augment on-going programs to provide for these needs. By providing additional access and hunting regulations that allow the opportunity for maximum sustained yield of the resources, the capability of the game resources will be sufficient to provide for the hunting demands for big and small game through the year 2020. The waterfowl capability will be sufficient through the year 2000. To provide for additional needs, either the habitat should be maintained at the 1980 level or additional waterfowl habitat should be created.

In addition to the preceding consumptive uses of wildlife, various nonconsumptive uses are also made of these resources. This study determined the needs for the activities of birdwatching, wildlife photography, and nature walks. These needs which would occur in the vicinity of S.M.S.A.'s of one million or more population were estimated to be 4.9, 13.7, and 24.1 million man-days for bench mark years 1980, 2000, and 2020, respectively. The development of wildlife facilities in proximity to major metropolitan areas is required, therefore, to provide for these needs.

The study also considered the habitat areas that should be preserved for the perpetuation of rare and endangered species.

RECOMMENDATIONS

We recommend that objectives of any plan for water development in the NAR include the following --

1. Conservation and enhancement of the indigenous warmwater fishery.

2. Conservation, enhancement, and creation of trout habitat and trout fishing opportunities.
3. Enhancement of the fishery based upon anadromous fish species.
4. Creation of additional lake-type fisheries.
5. Conservation and enhancement of estuarine-dependent sport and commercial fishery resources.
6. Preservation and enhancement of existing waterfowl habitat, and creation of additional waterfowl habitat needed for breeding, resting, feeding and to provide for waterfowl hunting opportunities.
7. Preservation of existing wildlife resources in connection with water resources development.
8. Creation of nonconsumptive wildlife-dependent recreational facilities in proximity to major metropolitan areas.

To accomplish these objectives will require (1) conservation (preservation) of existing high-value, free-flowing streams and natural lakes, (2) adequate control of polution at its sources, (3) construction of upstream water-storage facilities, (4) construction of shallow impoundments to provide wildlife habitat, (5) installation of fish-passage facilities necessary to restoration and maintenance of anadromous fish runs, and (6) public acquisition of sufficient lands to provide access for fishing, hunting, and non-consumptive recreational uses of fish and wildlife and for refuge areas.

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LEGEND
NAR BOUNDARY
SUB-REGION BOUNDARY
BASIN OR AREA BOUNDARY
SCALE IN MILES
25 0 25 50 75 100
ATLANTIC OCEAN
CANADA
A
B
C
D
E
F
1
2
3
4
5
6
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AUGUSTA
PORTLAND
CONCORD
BOSTON
PROVIDENCE
SPRINGFIELD
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ALBANY
ROCHESTER
BINGHAMTON
NEW YORK CITY
TRENTON
PHILADELPHIA
WILLIAMSPORT
HARRISBURG
BALTIMORE
DOVER
ANNAPOLIS
MARTINSBURG
WASHINGTON
RICHMOND
NORFOLK
LAKE ONTARIO
LAKE ERIE
LAKE CHAMPLAIN
ST. LAWRENCE RIVER
HUDSON RIVER
CONNECTICUT RIVER
SUSQUEHANNA RIVER
DELAWARE RIVER
DELAWARE BAY
SCHUYLKILL RIVER
POTOMAC RIVER
RAPPAHANNOCK RIVER
YORK RIVER
JAMES RIVER
CHESAPEAKE BAY
PENOBSCOT RIVER
KENNEBEC RIVER
ANDROSCOGGIN R.
MERRIMACK R.
NY
PA
VT
NH
MAINE
MASS
CONN
NJ
MD
DEL
VA
W VA
NC

CHAPTER 1. STATUS OF FISH AND WILDLIFE RESOURCES AND THEIR PRESENT USES

ORIENTATION

The information presented in this section of the report provides a reasonably accurate indication of the base year (1965, referred to as "present" or "current") resources in each area and the extent of their use, based on the best available information. This information is satisfactory for determining major problem areas and general needs of the people, but the reconnaissance nature of the data and the size of the areas being compared preclude its application in evaluation of specific projects.

WILDLIFE RESOURCES

Forest Big-Game Species

The various game species are considered on the basis of the principal type of habitat they require, that is, forest wildlife, agricultural wildlife, and waterfowl.

Forest wildlife species important in meeting recreational and other needs include big game such as white-tailed deer, black bear, and moose.

Deer are the most sought-after and most abundant big-game animal in the NAR. Their range extends from Maine to Virginia, and is interrupted only by the more densely populated urban areas.

The preferred habitat of deer includes woodland, forest-edge land, thickets along streams, and abandoned farm land. In the NAR, approximately 228,000 deer were harvested by hunters in 1965.

Black bear inhabit essentially the same type of habitat as deer. Bear are a trophy much in demand in recent years. They are numerous in only a few isolated areas and are not expected to increase significantly -- primarily because man will tolerate only a limited population of bears.

During 1965, bear kills by State were: approximately 1,500 in Maine, 200 in New Hampshire, 300 in Vermont, 500 in New York, 200 in Pennsylvania, and 200 in the remainder of the NAR.

Approximately 8,000 moose inhabit the near-wilderness areas of Maine. A few moose are also found in New Hampshire. Moose are not hunted at this time, though a limited open season has been considered in Maine. The current value of moose is their esthetic attraction -- an asset to the recreational industry.

Forest Small-Game Species

Since about 66 percent of the NAR is forested, forest small-game species are an important resource. These species are ruffed grouse, gray squirrel, varying hare (snow shoe rabbit), turkey, and raccoon.[1/]

Ruffed grouse and gray squirrel occupy essentially the same habitat as deer. Although hunters are inclined to place a higher value on the former, the squirrel harvest is approximately three times that of grouse in the NAR.

Grouse distribution is dependent on the abundance of shrubs and low-growing cover interspersed with forest land. This type of plant cover provides food, nesting areas, and protection for young. Forest edge created by abandoned farm land and logging roads is very attractive to grouse.

Squirrels are dependent on hardwood forest, primarily oak-hickory forests, for food and to a lesser extent for cover. Squirrels are most numerous in the sub-regions with more moderate temperatures.

Snowshoe rabbits or varying hares are fairly restricted by their habitat requirements. These animals prefer swampy areas interspersed with or immediately adjacent to relatively dense stands of conifers - preferably hemlock. Because of these habitat requirements, hares are not uniformly distributed. They are found in scattered pockets of habitat, primarily within the northern one-third of the NAR.

The abundance or scarcity of the varying hare (as well as ruffed grouse) is associated with inherent cyclic behavior. The cyclic period during which numbers reach a peak is considered to be about ten to twelve years; after the peak, their numbers sharply decline. This cycle behavior, of course, affects capability for meeting the annual needs of hunters.

Historically, wild turkeys were widely distributed in the NAR, but were virtually eliminated as the country was settled and developed. The turkey is a highly desirable forest-game bird and has been restored in relatively large sections of the western

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1/ The adaptibility of the raccoon allows him to fit into many habitats - even the urban. His characteristics (and this wide distribution) fit him for many uses -- game animal, fur animal, pet, non-consumptive recreational resource, etc. As long as habitats for other wildlife are maintained, adequate populations of raccoons will be present. No special planning is or will be necessary on his behalf.

portion of the Region. At present, Pennsylvania, New York, Virginia, and Maryland support the bulk of the wild turkey population in the study area. Some population expansion may be anticipated through intensified management on key areas of good quality habitat.

Farm Small-Game Species

Just as deer, bear, grouse, hare, turkey, and squirrel are associated with forest lands, so pheasants, cottontail rabbits, and bobwhite quail are generally associated with agricultural lands. The habitat requirements of the several farm-game species vary considerably, however.

The pheasant is not a native but through repeated stocking has come to thrive in those areas most suitable for its growth and survival. It has definite limits as to temperature, humidity, food, and mineral requirements - all limiting its natural range.

Recognizing these habitat requirements, it is immediately apparent that most of the pheasant habitat in the NAR is far from ideal. Because of limited natural reproduction, the supply of pheasants does not meet the demand for this bird. To assist in meeting these demands, large numbers of pheasants are pen-reared and stocked to supplement resident supplies.

The habitat requirements of cottontails are not as restrictive as those of the pheasant, although cottontails prefer a warmer and somewhat drier climate. They enjoy a varied diet, preferring annual plants, grasses, and legumes. Cereal grains are not a requirement, though they are used when they are available. Highly calorifacient grains permit them to survive severe winter weather they could not tolerate if such food were not available.

Cottontails are a popular small-game species. Supplies of these animals approach or meet the demands of hunters in the western and southern three-fifths of the NAR. It should be noted that cottontails during periods of abundance become a nuisance since their feeding habits damage ornamental trees, shrubs, and gardens.

The bobwhite is one of the most popular of all small-game birds. Bobwhites thrive in agricultural areas where diversified farming is practiced. They are especially adapted to edge-growth habitat which provides nesting cover, protection from predators, and access to foods consisting of annual plants and their seeds, cereal grains, and legumes. They cannot survive severe winters. Extended periods of snow cover isolate them from food supplies and they perish. Although some are distributed over portions of the Cape Cod area and Connecticut, they are much more

numerous and widely distributed southward and westward from Long Island.

Migratory Birds

Waterfowl -- ducks, geese, swans, and various other species -- are migratory. In the NAR nesting occurs mainly in the northern portion and additional birds are produced even farther north, that is in Canada rather than in the United States. Although both woodcock and mourning dove are migratory, the woodcock is primarily a forest inhabitant and the dove is associated with agricultural lands.

Waterfowl migrate over rather distinct routes. Major routes are the Pacific, Central, Mississippi, and Atlantic flyways. Of the many species in the Atlantic flyway, which serves the NAR, the Canada goose, brant, black duck, redhead, scaup, canvasback, teal, woodduck, and mallard are especially attractive to hunters.

All waterfowl require resting and feeding areas during their migration. On their wintering grounds, they require open water and protection from the elements as well. The many inland waterways, ponds, and lakes of the interior and the inlets, bays, and harbors of the Atlantic coast provide excellent habitat for migratory waterfowl. Where extensive good quality habitat occurs, large numbers of waterfowl concentrate. Noteworthy among these concentration areas are the following:

Merrymeeting Bay -- Concentrations of Canada geese and black ducks in the spring and black ducks and teal in the fall.

Long Island Sound and Adjacent Waters -- Winter concentrations of black ducks, scaup, scoters, Canada geese, and brant, fall concentrations of black duck and scaup, and large numbers of scoters in spring.

Delaware Bay -- Fall and winter concentrations of Canada geese, black duck, scaup, and mallards, and spring concentrations of pintails.

Chesapeake Bay -- Fall and winter concentrations of black ducks, canvasback, scaup, and Canada geese.

South East Coastal (New Jersey, including Great South Bay) -- Fall and winter concentrations of black ducks, brant, scaup, and pintails.

Cape Cod, Mass. -- Late fall and winter concentrations of eider, scaup, and scoters.

Woodcock require moist lands where they can feed on earthworms and other similar food items. Good quality habitat for this bird is scattered throughout the NAR, but is most abundant in Maine, New York, Connecticut, Maryland, Massachusetts, New Jersey, and Pennsylvania.

Many woodcock are taken as an incidental item in the course of hunting grouse, varying hares, and pheasants. In good quality habitat where flight birds concentrate, woodcock are a significant addition to wildlife resources.

Although mourning doves are distributed throughout the Region, they are not numerous in the northeastern portions of the NAR. West and south of Long Island, New York, they become more numerous. They are relatively abundant in Maryland and Virginia where they have long been considered a game bird. In Pennsylvania, Delaware, and Rhode Island, mourning doves are also an important segment of the small-game resource.

Fur Animals

Fur animals are distributed throughout the NAR. Demands for these animals are influenced by market prices, which in turn are influenced by fashion demands. These demands are highly artificial and very flexible. When the demand for a specific fur exceeds the supply on hand, prices for raw pelts of that animal increase. Continued demand beyond the level of the existing supply would result in further increase in pelt prices and continued harvest to meet this level of demand would eventually exhaust the supply. Economic pressures of precisely this type were responsible for virtual destruction of the beaver resources of the United States during the early days of the nation. These factors are recognized by state agencies responsible for fur animals, and harvests are regulated to maintain supplies. On the other hand, during periods when their pelts are not in demand, populations of certain fur animals may increase to the point where these animals become a nuisance.

Where supplies of native wild stocks cannot meet demand and prices justify domestic production of these animals, the demand will be met, if practicable to do so, by supplementary supplies produced by private enterprise.[1/] Despite fashion changes and other factors which influence the demand for fur animals and in consideration of the large areas of good quality habitat for fur animals in the NAR, the fur-animal resource is expected to be equal to meeting future demands.

1/ Some species, however, do not adapt to commercial production.

FISHERY RESOURCES

Major Categories

Fishery resources in the NAR are of three general types: fresh-water, salt-water, and anadromous fisheries. The salt-water and anadromous fisheries are subject to harvest both by commercial interests and sport fishermen. Fresh-water fisheries are used intensively for recreation and to a much lesser extent, commerce. There are two distinct categories: warm-water fisheries and cold-water fisheries.

Fresh-water Fisheries

Cold-water Species

Very briefly, cold-water fishes may be defined as those species which require water temperatures not exceeding 75 degrees Fahrenheit. Practically all of the important cold-water species in the NAR belong to the salmonid group of fishes - trout and salmon. A number of these species, notably rainbow trout, brown trout, brook trout, lake trout and landlocked salmon lend themselves to hatchery production and can be produced in large numbers in a limited space at a relatively low cost: thus, these species are most useful as a means of producing supplementary supplies to meet demands exceeding the natural reproductive capacity of this resource.

The most important cold-water species in the NAR are:

a. Brook trout
b. Brown trout
c. Rainbow trout
d. Landlocked salmon
e. Lake trout
f. Smelt

Only the salmon, brook trout, lake trout and smelt were present historically in the NAR, the brown trout having been introduced from Europe and the rainbow trout transplanted from the western slope of the Rocky Mountains.

Presently, cold-water fisheries can be found throughout 90 percent of the NAR, though perhaps as much as one-third of the habitat which sustains these fish is suitable only in certain seasons of the year or is of marginal quality on a year-round basis. Many small streams and lakes which provide habitat temporarily

suitable for cold-water fish are stocked with trout during early spring and thus provide cold-water fisheries during this period of the year. Some of these waters will not sustain trout when the temperature rises in summer and would normally be classified as warm-water habitat. The management technique of stocking fish of sufficient size to permit legal possession -- fish which are immediately available to the fishermen in both cold and marginal trout waters -- permits the resource abundance to stay abreast of the ever-increasing demand.

Brook trout are widely distributed in small cold-water tributaries of the NAR. Brown trout and rainbow trout have an even wider distribution than brook trout since they are adapted to streams somewhat larger and warmer than those usually inhabitated by brook trount.

Distribution of landlocked salmon and lake trout is limited primarily to the larger, cold-water lakes. They also exist in some of the larger rivers in the vicinity of large lakes. Most of the landlocked salmon and lake trout are found in Maine and to a lesser extent in New Hampshire, Massachusetts, Vermont, and New York.

Lake trout are perhaps more common than landlocked salmon though neither are considered abundant even in the best of habitat. Both lake trout and landlocked salmon are premium recreational resources; both are highly desirable and in short supply.

Smelt -- a small trout-like fish which rarely exceeds ten inches in length -- is an important salt-water fish of the coastal waters. It is anadromous but easily establishes landlocked populations. It is usually stocked in combination with landlocked salmon to provide forage for the salmon.

Originally, smelt were distributed throughout the coastal waters from New Jersey to Maine. Today they are most common from Rhode Island to Maine. They are an important commercial food fish in coastal salt waters and an important sport fish wherever they exist in catchable numbers.

Warm-water Species

Warm-water fishes are those species which prefer waters with summer temperatures ranging from 70 to 90 degrees Fahrenheit. Within this group, however, there is considerable variation in preference. Walleye and smallmouth bass, for example, favor the lower part of the range (70° to 80°) and do well even in waters with maximum temperatures of 60° to 70°F. Large-mouth bass like it a little warmer 75° to 80°F, while the brown bullhead and others do better between 80° to 90°F. All are capable of enduring the winter

temperatures within their natural ranges, but, like the smallmouth bass, may not begin to feed actively until water warms to about 60°F. The most important warm-water species in the NAR are:

a. Smallmouth bass
b. Largemouth bass
c. Northern pike
d. Catfishes
e. Panfish 1/
f. Walleye
g. White perch
h. Chain Pickerel
i. Muskellunge

Habitat suitable for warm-water fisheries becomes progressively more extensive as one moves southward through the NAR. In the transition zone between warm-water habitat and cold-water habitat, considerable overlap occurs. Warm-water fish are often found in cold-water habitat but as a rule, they grow more poorly under such conditions, compete with the cold-water species, and are considered undesirable. On the other hand, introduction of smallmouth bass into marginal habitat for salmonids may result in the former taking over.

Anadromous Fishes

A number of species of fish spawn in fresh water, migrate of the ocean where they grow to maturity, and return to fresh water when they are ready to spawn. These species are known as anadromous fish.

Some species presently contributing to the harvest of anadromous fish are:

a. Striped bass
b. American shad
c. White perch
d. Smelt
e. Alewives
f. Blueback herring
g. Atlantic salmon
h. Sea-run trout 2/

1/ Panfish includes such fish as bluegills, green sunfish, pumpkinseed, crappies, rock bass, yellow perch, and various other species.

2/ These are rainbow, brown, and brook trout which have adapted anadromous habits. Generally in New England they are called "salter" regardless of species.

Historically, large runs of anadromous species ascended practically every river draining into the ocean within the NAR. With the advent of the white man and the subsequent industrial revolution, these runs were gradually reduced or eliminated entirely through pollution, over-fishing, construction of dams, insufficient flows, etc. Presently, the once abundant annual runs of fish are greatly reduced in size and those of significance are limited to just a few rivers within the NAR.

Several of the species that comprise this category of fishes are among our most prized and, therefore, most valuable sport fish. These fish are also harvested commercially, which further increases their resource importance.

It is a characteristic of many, if not all, of these species that they generally return to the stream of their origin to reproduce and thus individual races that confine their "runs" each to a specific river have evolved. This is an important factor in that they are harvested primarily during these annual spawning migrations into an estuary and up the river. Each river supporting such runs is important in providing a portion of the total commercial harvest and in providing sport fishing for the people in the local area.

On the Atlantic coast striped bass occur from northern Florida to New Brunswick and Nova Scotia. In the southern part of their range, they tend to remain within protected waters during their whole life span. From Chesapeake Bay to New England, however, substantial numbers leave their birthplaces when about three years old, migrating in groups generally north in summer and south in winter. Along their migration route, they provide a highly attractive resource for both anglers and commercial fishermen.

Although it may be true, as has been generally accepted, that the bulk of the striped bass migrating along the north Atlantic coast originate in Chesapeake Bay, particularly from eggs spawned in waters at the head of the Bay and in the Potomac River 50-80 miles from its mouth, the contribution made by other areas should not be overlooked or depreciated. One important river in this respect is the Hudson. Evidence indicates significant reproduction also occurs in New Jersey and Delaware rivers. It is possible a significant contribution is made, also, by fish spawned in Delaware River and tributaries to Delaware Bay.

Supplies of anadromous fish, generally, do not meet the present needs of either sport fishermen or commercial fishermen. It is difficult to anticipate future supplies of these fish. Cooperative efforts of the U.S. Fish and Wildlife Service and the several states have been directed toward the restoration of Atlantic salmon and other important anadromous species for many years

and are continuing. The potential rewards of a restored anadromous fishery are perhaps greater than the potential for any other segment of the NAR fisheries.

Estuarine-Dependent Marine Fishes

One of the major problems facing the world today is the problem of providing an adequate supply of food. Hopefully, one potential source of large quantitites of food is the sea around us, and many credible authorities anticipate that large quantities of our future food supply will come from the oceans of the world.

In this study, we concern ourselves with a major segment of salt-water fish and shellfish -- the estuarine-dependent species.

An estuary is a body of water in which fresh water mixes with and measurably dilutes sea water. These mixing zones are among the most productive aquatic habitats in terms of the quantity of fishery resources that can be supported. This is due largely to (1) the fertilizing elements constantly being introduced by outflow from the land and (2) the growth of plant and animal organisms encouraged by both fertilization and adequate light penetration because of the relatively shallow depths of water.

On land a crop is grown and harvested in place; in tidal estuaries, there is continuing movement to and from the primary sources of productivity which are the tidal marshes and the mud flats. Nutrient materials are constantly brought in by the flow from land and the food items into which they are converted are dispersed into the estuarine waters by the circulation of the tides.

The tidal marshes and mud flats thus support an abundance of free-floating organisms, both plants and animals. These planktonic organisms, as they are called, are in turn fed upon by larger organisms; these serve as food for small fishes and crustacea, which in turn support the larger fishes and other animal life of the estuary.

Oysters flourish only in those estuarine areas where freshwater inflow reduces salinities sufficiently to permit oyster growth in the absence of predacious starfish and oyster drills which require relatively high salinity ranges.

Numerous other marine species require low salinity waters (anadromous fish, crabs, etc.). Flow patterns of the estuaries assist the larval stages of our important commercial shellfish to reach a suitable place where they can attach and thus survive. Without the estuarine environment, many marine organisms could not survive.

To appreciate the importance of estuarine production, we

should note that the annual consumption of fish and shellfish in the United States is approximately 11 pounds per capita. At this time about 50 percent of these supplies are imported. These imports consist of every category of fish and shellfish from every conceivable source, and of course, include fresh-water, estuarine-water, and salt-water products.

Here in the North Atlantic Region, about 228,928,000 pounds of estuarine-dependent edible fish and shellfish were harvested during 1965. This rate of harvest provided 4.8 pounds of food for each individual in the NAR in 1965.

RARE AND ENDANGERED SPECIES

The deterioration and reduction in habitat of many fish and wildlife species is of major significance in the perpetuation of these resources. When a type of habitat of certain essential qualities are lost, certain species suffer a reduction in abundance and may ultimately be threatened with extinction. What constitutes a "rare" or "endangered" form of fish and wildlife may be somewhat debatable but, for the purpose of this report, the following terms are used:

Endangered -- One whose prospects of survival and reproduction are in immediate jeopardy. Its peril may result from one or many causes -- loss of or change in habitat, over exploitation, predation, competition, and disease. An endangered species must have help or extinction will probably follow.

Rare -- One that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

Peripheral -- One whose occurrence in the U.S. is at the edge of its natural range and which is rare or endangered within the U.S., although not in its range as a whole. Special attention is necessary to assure retention in our nation's fauna.

In the United States there are presently 142 species of fish fish and wildlife that are considered rare and/or endangered. There are an additional 80 species that are considered peripheral.

In the North Atlantic Region there are at least 14 rare and endangered species and one peripheral species. Included in this total are four mammals, two birds, six fish, one reptile and one amphibian. This distribution and classification of these species are listed in Table 0-1. Table 0-2 shows relationship between occurrence of such species in the NAR and in the entire United States.

TABLE 0-1
RARE, PERIPHERAL AND ENDANGERED FISH AND WILDLIFE 1968-1969

NORTH ATLANTIC REGION GENERAL

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
Bog turtle Clemmys muhlenbergi	Reptile	Rare	Isolated colonies from Connecticut to southwestern North Carolina. Restricted to fresh-water marshes, meadows, and bogs.	Extensive destruction of habitat for cultivation. Collected by dealers for sale in pet trade, where they command a high price due to rarity.	Bog turtles are protected by law in New York State.	None - Wildlife monument conserving area of suitable habitat would be appropriate.	
Southeastern pine grosbeak Pinicola enucleator eschatosus	Bird	Peripheral	Breeds from Northern New England north to central Quebec and Newfoundland. Winters in breeding range and occasionally south to Virginia.				Peripheral species whose occurrence in the U. S. is at the margin of their natural range - though it may not be endangered everywhere, its retention in our Nation's fauna is a matter of concern.
Southern bald eagle Haliacetus leucocephalus	Bird	Endangered	Nests primarily in estuarine areas of Atlantic and Gulf coasts, locally from New Jersey to Texas and lower Mississippi Valley southward from eastern Arkansas and western Tennessee.	Increase in human population in primary nesting areas. Disturbance of nesting birds, illegal shooting, loss of nest trees, and possible reduced reproduction as a result of pesticides injested with food by adults.	Federal laws in U. S. protect both bald and golden eagle. Studies on effects of pesticides on eagles. Eight National Wildlife Refuges in southeastern U. S. have bald eagles nesting on them. Studies of distribution, breeding, biology, and limiting factors.	Continued surveillance of nest sites. Continued research on effects of pesticides and other presumed limiting factors.	

TABLE 0-1 Continued

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
NORTH ATLANTIC REGION GENERAL (Cont'd)							
American peregrine falcon Falcon peregrinus anatum	Bird	Endangered	Formerly bred in Eastern U. S.; now limited to non-Arctic portions of Alaska and Canada south to Baja, California (except coast of southern Alaska and British Columbia), central Arizona, southwest Texas, Mexico (locally), Colorado and Quebec. Winters chiefly in breeding range; more northern birds moving to southern part.	Strongly suspect cumulative effects of pesticide poisons obtained from tissues of prey. May have killed birds directly or prevented reproduction. Other reasons include nest molestation by man and shooting by hunters and farmers.	Peregrine falcons are "protected" by laws of most of states in U. S.	Determine limiting factors by thorough study of pesticidal content of food, eggs and tissues of any dead specimens received; also assembling all information available on mortality of these birds. Set appropriate regulations for protection (and see that they are enforced). Experiment with captive propagation. Include in International conservation agreements. Note: Breeding potential in captivity is probably poor.	
COASTAL AREAS GENERAL							
Ipswich sparrow Passerculus princeps	Bird	Rare	Breeds on Sable Island off Nova Scotia. Winters among sand dunes along Atlantic coast from Sable Island south to southern Georgia.	Reduction in size of breeding area by progressive washing away of already small Sable Island. Interference with winter habitat by residential development along Atlantic coast beaches.	Establishment of Chincoteague National Wildlife Refuge and of Cape Cod and Cape Hatteras National seashores will prevent destruction of habitat in these three places.	Set aside additional National seashore areas along Atlantic coast and encourage preservation of sand dunes in natural condition on properties under private ownership.	

TABLE 0-1 Continued

COASTAL AREAS GENERAL (Cont'd)

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
Atlantic salmon Salmo salar	Fish	Endangered In U.S. not throughout its range	Found in limited numbers in eight coastal streams in Maine. Former Distribution: Common in New England streams from Cape Cod northward.	Pollution, obstruction created by dam construction and periodic major fluctuations in waterflows.	Salmon have been stocked from Craig Brook National Fish Hatchery, also produced at Maine State Hatchery at Palermo. Commercial fishing in streams made illegal in 1948: cooperative Federal State investigations sea run salmon commissions.	Pollution abatement provision of adequate fish passage facilities at dams, waterflow stabilization and enlargement of hatchery facilities.	Landlocked populations have increased in numbers and distribution because of stocking programs carried out by the Maine Department of Inland Fisheries and Game.
Atlantic right whale Eubalaena glacialis	Mammal	Endangered	From Iceland to Bermuda along coasts.	Commercial exploitation by whalers.	International Whaling Commission recommended necessary conservation measures to contracting governments for implementation.		For many years an attractive quarry for whalers off New England coast. Possibly a few hundred persist.
Atlantic sturgeon Acipenser oxyrhynchus	Fish	Rare	Atlantic Coast from St. Lawrence River to northern Florida.	Pollution of rivers and estuaries and obstruction in spawning streams.	Commercial fishing restrictions. Measures which will aid Atlantic salmon, striped bass, and shad will aid in sturgeon restoration.	Pollution abatement, improved fish passage facilities and stream flow fluctuation control.	

TABLE 0-1 Continued

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
ST. JOHN & PENOBSCOT BASINS (A-1 AND A-2)							
Blue back trout Salvelinus oquassa	Fish	Rare	Located in at least eight lakes in the headwaters of St. John and Penobscot Rivers in Maine.	Unrestricted exploitation of spawning runs. Also related to increased populations of landlocked salmon in Rangeley Lakes.	Restricted creel limits, prevention of introduction of undesirable competing species.	None	
MAINE COASTAL (A-5)							
Sunapee trout Salvelinus aurealus	Fish	Rare	Floods pond Hancock County, Maine	Extensive hybridization following introductions of other chars to the native waters of these species.	Floods pond closed to fishing as a public water supply opposition to introduction of other species.	None	Pure stocks of this species can not exist sympatrically with the Lake trout; therefore, artificial propogation and distribution is not recommended.
MASSACHUSETTS AND RHODE ISLAND COASTAL AREA (B-9)							
Beach meadow vole Microtus breweri	Mammal	Rare	Muskegat Island off Nantucket, Mass.	Predation by short-eared owls and by cats kept at Life Saving Station; habitat eliminated by erosion after storms and by construction.	Muskegat Island now a refuge for nesting terns	Encourage suitable perennial grass habitat Maintain refuge eliminate cats.	
Block Island meadow vole Microtus pennsylvanicus provectus	Mammal	Rare	Block Island, Newport County, Rhode Island	Construction of buildings and roads on island; effects of storms and hurricanes. Cultivation has altered habitat.	None	Encourage continued existence of suitable perennial grass habitat	

TABLE 0-1 Continued

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
HUDSON RIVER BASIN (C-12)							
Short nose sturgeon Acipenser brevirostrum	Fish	Endangered	All recent records are from Hudson River except one Florida specimen. Former distribution: Atlantic seaboard, including Hudson, Delaware, Potomac, Connecticut, etc.	Pollution is major factor. Over fishing also likely - fished extensively on spawning areas - also been taken in shad gill nets.	None Other than routine regulations. (20 inch size limit	Survey of status of the species would be basic to development of a plan. Locating all spawning areas would be key to development of effective protection.	
NEW JERSEY COASTAL (D-16)							
Pine Barrens tree frog Hyla andersoni	Amphibian	Rare	Pine barrens area of southern New Jersey; one or two small colonies in North Carolina: may also occur in Georgia.	Areas in southern New Jersey inhabited by this frog are undergoing rapid development for housing and industry. Manipulations of lake levels for recreation purposes makes the habitat unsuitable for the species. If plans for a jet airport are completed, there will be practically no habitat left for this frog.	None	Establishment of a wildlife monument in the pine barrens of New Jersey would benefit this species of amphibian as well as several other amphibian and and reptiles feeling the encroachment of civilization on the east coast.	Approaching the endangered stage.
SUSQUEHANNA RIVER BASIN (E-17)							
Maryland darter Etheostoma sellare	Fish	Endangered	Found only in Swan Creek, a small stream 3 to 15 feet wide near Havre de Grace, Maryland.	No data to support a statement that they have declined.	Biologists have been requested not to disturb habitat.	Same	Present habitat near area of commercial and residential development.

TABLE 0-1 Continued

DELMARVA PENINSULA (F-18d)

NAME	CLASS	RATING	DISTRIBUTION	REASON FOR DECLINE	PROTECTIVE MEASURES TAKEN	PROTECTIVE MEASURES PROPOSED	REMARKS
Peninsula fox squirrel Scirus niger cinerus alias bryanti or neglectus	Mammal	Endangered	Queen Annes, Dorchester, Talbot, Wicomico, Somerset, and Worcester Counties, Maryland	Hunting for food and sport, disruption of habitat through timber cutting, agriculture, road-building construction and fire.	Establishment of Blackwater National Wildlife Refuge and Pocomoke State forest have helped to preserve some habitat.	Close hunting season initiate studies to determine optimum habitat requirements; establish more refuges on the Peninsula.	Threatened with immediate extinction.

TABLE O-2

COMPARISON OF RARE AND ENDANGERED AND PERIPHERAL FISH AND WILDLIFE SPECIES IN THE UNITED STATES AND THE NAR
1968-69

SPECIES	NUMBER IN THE UNITED STATES	NUMBER IN THE NAR
Rare and Endangered		
Mammals	32	4
Birds	60	2
Fishes	38	6
Reptiles	5	1
Amphibians	7	1
TOTAL	142	14
Peripheral		
Mammals	8	0
Birds	65	1
Fishes	4	0
Reptiles	3	0
Amphibians	0	0
TOTAL	80	1

Merely focusing attention on those species of this region that are threatened is not enough. If the general indifference to the preservation of a wild species is allowed to continue there will be numerous other species joining the present list of those now extinct as well as adding new ones to the rare and endangered list.

Permitting the indiscriminate destruction of depreciation of habitat may result in the irreplaceable loss of environmental qualities, together with plants, animals and natural communities. With natural habitat rapidly disappearing there must be continuing emphasis placed on development and implementation of measures to assure retention or creation of desired habitats and communities if vanishing species are to be preserved.

CURRENT MAGNITUDE OF USE

Hunting

Current use as it refers to figures in this appendix is not now an appropriate term. These figures represent use in the base year 1965 from which projections were subsequently made. The "current" number of hunters was determined from resident and nonresident license sales in 1965 and/or available estimates of the number of hunters in each county within a given drainage area. In instances in which these specific data were lacking, the number of hunters in a given drainage area was determined by applying to its total population the statewide percentage of the total population that hunted. County population estimates for 1965 were used for determining total population in each drainage area.

Total hunters within a drainage area, as determined by one of the above procedures, were further analyzed as to how many hunted each particular species. This breakdown according to hunting preference was made on the basis of data available from several of the NAR states. The number of man-days of hunting per species was then estimated by multiplying the number who hunted by the average number of days spent afield in pursuit of each kind of game. The average hunter-days per species or category of game was obtained from the 1965 National Survey of Fishing and Hunting, (Bureau of Sport Fisheries and Wildlife Resource Publication 27).

These estimates are admittedly rough -- data available (and the lack of them) permit nothing better. It is believed, however, that the degree of accuracy achieved is sufficient to give a useful comparison between existing supply and demand which will be helpful in development of the regional plan. Current magnitude of hunting use in the NAR is estimated to be:

a. 9.7 million man-days by 1.4 million big-game hunters;

b. 27.0 million man-days by 2.5 million small-game hunters, and
c. 1.5 million man-days by 223,000 waterfowl hunters.

Sport Fishing

Fresh-water species

Resident. Based upon resident and non-resident license sales in the several NAR states and the estimated numbers of unlicensed fishermen, the total number of individuals involved in current fishing use in NAR waters was derived. The numbers of fishing licenses purchased were those presented in the Fish and Wildlife Service News Release dated April 12, 1967. Numbers of unlicensed fishermen were calculated from information provided in the 1965 National Survey of Fishing and Hunting. Also obtained from that source was the average annual number of days fished by each individual (a national average). Use was proportioned between warm-water and cold-water fisheries in accord with information provided by the states for incorporation in the National Survey of Needs for Hatchery Fish, 1968, conducted by the Bureau of Sport Fisheries and Wildlife.

Current level of participation and average number of days fished annually is as follows:

	No. of Fishermen	Days Fished
Cold-Water Streams	614,000	11.1 million
Warm-Water Streams	430,000	7.9 million
Cold-Water Lakes	614,000	11.3 million
Warm-Water Lakes	1,443,000	26.4 million
TOTALS	3,101,000	56.7 million

Anadromous. Anadromous fishes provide a fishery only in certain fresh-water streams or portions of such streams which are not blocked by dams or rendered unsuitable by pollution. In addition, anadromous species provide part of the sport-fishery resource in estuarine waters (i.e. those in which there is a mingling of fresh and salt). The use in the estuarine portion will be discussed later under salt-water fisheries.

Sport-fishing for anadromous species in fresh water has been computed, on advice from state fishery authorities, as a percentage of the total fresh-water fishing pressure. On this basis, it is estimated that 112,000 fishermen spend 2.1 million man-days annually enjoying fishing for anadromous fishes where and when they are available in fresh-water streams. In the vicinity of many streams which once supported anadromous fish "runs", there exists a tremendous latent demand for such fishing opportunity, since the

major species, American shad, striped bass, and Atlantic salmon are outstandingly attractive to the angler.

Salt-water. Sport-fishing use of salt-water fisheries was estimated by using as a starting point the data provided by the 1965 Salt-Water Angling Survey. These data were subsequently considered as related to (1) other basic information contained in the National Survey of Fishing and Hunting, 1965 correlated with service area populations; (2) estimates of use based on distribution of the principal species appearing in the sport fishing harvest correlated with the service area population in each state; and (3) estimates of use of marine resources furnished by knowledgeable individuals. As a result of the foregoing processes, estimated fishing effort expended on the salt-water species in the NAR is estimated to be 36.6 million man-days, annually.

Other Recreational Uses

According to the 1965 survey of national recreation conducted by the Bureau of Outdoor Recreation, there were eight million bird watchers and three million wildlife photographers. There are also additional uses which as yet have not been quantified. For example, fishways in use by salmon, shad, or other anadromous species attract many thousands of visitors each year, as do aquariums and fish hatcheries. Other thousands of people find doubly rewarding activity in digging clams or harvesting other types of shellfish. Skin divers are often motivated by desire to observe underwater animals in their native haunts while others enjoy the sport of spear-fishing.

Commercial Fishing

During 1965, the harvest of estuarine dependent fishery and fishery-related resources for commercial purposes amounted to 790,228,000 pounds (see Table 0-9). This harvest was comprised of the following items:

Fishes used in industry -- 559,715,000 pounds. This was made up of alewives and menhaden, species which are a source of oil, fish meal, and pet food. Recent developments have made the menhaden also a potential source of fish protein concentrate (FPC) for human consumption.

Fishes used for food -- 88,809,000 pounds of finfishes and 140,119,000 pounds of shellfishes. This represented 4.8 pounds of seafood for each person in the NAR in 1965. Present annual consumption of fish and shellfish in the United States is approximately 11 pounds per capita, of which approximately 50 percent is imported.

Fish bait -- 1,585,000 pounds of sandworms and bloodworms.

ECONOMIC IMPACT OF CURRENT (1965) USE

Recreational Activities

Recreation related to fish and wildlife resources generates a considerable flow of money for associated goods and services. A large portion of such expenditures occurs in the localities where the recreative activities take place, but the home towns of the recreationists derive considerable benefit as do establishements along routes of travel. Three national surveys of fishing and hunting (1955, 1960, and 1965)1/ have been conducted. From them, data are available as to the magnitude of expenditures in connection with these recreational pursuits. Expenditures related to the other forms of recreation related to fish and wildlife have not been intensively investigated as yet.

The following estimates of annual expenditures for hunting and fishing in the North Atlantic Region are based upon use estimates presented earlier in this report and upon average expenditures per hunting or fishing day as given in 1965 National Survey of Fishing and Hunting:

Type of Hunting or Fishing	Average $$ Spent per day	Total No. Days	Total $ Expended
Big Game Hunting	9.55	9.7 million	92.6 million
Small Game Hunting	4.79	27.0 million	129.3 million
Waterfowl Hunting	6.44	1.5 million	9.7 million
Freshwater Fishing	4.98	58.8 million	292.8 million
Saltwater Fishing	5.92	36.6 million	216.7 million
TOTALS	--	133.6 million	$741.1 million

With the exception of saltwater fishing expenditures, which are specific to the Atlantic Coast, the above figures represent national averages. In all likelihood, therefore, the estimated total annual expenditure is a conservative figure for the North Atlantic Region. This conclusion is based upon two factors: (1) the ratio of expenditures per day between residents of standard metropolitan areas and those outside such areas, both non-farm and farm dwellers; and (2) the ratio of hunters and fishermen who reside in standard metropolitan areas in the NAR compared to the number of similar residents on a nationwide basis.

Average expenditures per hunting or fishing day by

1/ A fourth such survey was conducted in 1970; data, however were not available for use in this study.

residents of S.M.S.A.'s[1/] compared with those who do not reside in such areas are as follows:

	Expenditures per Day by Place of Residence		
	In S.M.S.A.'s	Not in S.M.S.A.'s	
		Non Farm	Farm
Fishermen	$6.79	$4.34	$2.76
Hunters	$8.30	$4.98	$2.85

Nationwide, only 17.6 percent of the fishermen and 6.7 percent of the hunters are residents of standard metropolitan areas. It seems reasonable to assume that in the NAR the proportion of such hunters and fishermen exceeds the national average.

Commercial Fishing

The marketing of fish, shellfish, and other products harvested from the sea in 1965 produced income in the amount of $18.2 million for finfishes, $39.8 million for shellfishes, and $1.3 million for seaworms used for bait. (see table 0-9). Total contribution to the economy from sales "at the landing" amounted to $59.3 million.

SUMMARIES OF STATUS

Wildlife

Tables 0-3 and 0-4 summarize the status of major game species for the base year, 1965, in terms of hunter-days of recreation (use), resource capability for meeting needs at presently acceptable levels of satisfaction (supply), and extent of available habitat. In essence, the extent and quality of habitat in 1965 and the wildlife populations therein had a capability for providing opportunities for recreational hunting slightly in excess of demand, within the Region as a whole.

Habitat totals for big game, small game, and waterfowl in Tables 0-3 and 0-4 are not additive, since ranges for these wildlife categories are overlapping. When a given category, e.g., forest small game, figures shown in parenthesis indicate that the habitat

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1/ "Standard Metropolitan Statistical Areas" as defined by Bureau of Budget (now Office of Management and Budget). Every city of 50,000 inhabitants or more according to the 1960 Census of Population is included in an SMSA.

TABLE O-3
EXTENT OF HUNTING RECREATION (USE) AND RECREATIONAL OPPORTUNITY (SUPPLY) AND AVAILABLE HABITAT FOR GAME SPECIES - 1965
(Figures in thousands)

Basin No. A-1

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	18	118	220	6.6	42	4.5
Bear	1	6	6	(6.6)	1.7	0.4
Big-game total	19	124	226	6.6	-	-
Forest Small-game						
Grouse	7	90	106	6.6	334	43
Hare	4	47	48	(6.6)	118	34
Squirrel	1	11	13	(6.6)	27	6
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	0	0	0	0	0	0
Pheasant	3	39	84	.8	3	1
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	1	5	8	(1.6)	165	10
Dove	0	0	0	0	0	0
Small-game total	16	192	259	7.4	-	-
				Acres		
Waterfowl total	1	11	6	26	16	6

Basin No. A-2

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	36	240	240	6.8	36	8.6
Bear	2	11	11	(6.8)	1.8	.5
Big-game total	38	251	251	6.8	-	-
Forest Small-game						
Grouse	15	182	182	6.8	202	36
Hare	8	96	96	(6.8)	62	18.5
Squirrel	2	22	29	(6.8)	10	2
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	0	0	0	0	0	0
Pheasant	7	79	79	.9	4	3
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	2	11	11	(.6)	63	6
Dove	0	0	0	0	0	0
Small-game total	34	390	397	7.7	-	-
				Acres		
Waterfowl total	3	24	35	199	62	8

Table 0-3 (Cont.) ----- Basin No. A-3

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	21	143	190	5	46	7
Bear	1	7	7	(5)	1.2	.3
Big-game total	22	150	197	5	-	-
Forest Small-game						
Grouse	9	108	108	5	253	41
Hare	5	57	71	(5)	161	36
Squirrel	1	13	13	(5)	21	6
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	0	0	0	0	0	0
Pheasant	4	46	47	1	11	8
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	1	6	6	(.7)	68	7
Dove	0	0	1	(1.1)	5	0
Small-game total	20	230	246	6	-	-
				Acres		
Waterfowl total	2	14	14	89	56	12

Basin No. A-4

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	19	129	200	2.9	31	4
Bear	2	10	10	(2.9)	.7	.2
Big-game total	21	139	210	2.9	-	-
Forest Small-game						
Grouse	8	98	98	2.9	237	43
Hare	4	52	52	(2.9)	81	34
Squirrel	1	13	16	(2.9)	23	5
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	.1	1	1	(.1)	18	6
Pheasant	4	45	45	.5	20	16
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	.2	7	7	(.3)	46	12
Dove	0	0	1	(.8)	4	0
Small-game total	19.1	216	220	3.4	-	-
				Acres		
Waterfowl total	2	13	13	18	57	18

Table 0-3 (Cont.) ----- Basin No. A-5

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	26	176	184	4.8	47	8.7
Bear	1	9	16	(4.8)	1	.1
Big-game total	27	185	200	4.8	-	-
Forest Small-game						
Grouse	11	133	312	4.8	143	11
Hare	6	69	77	(4.8)	52	14
Squirrel	1	16	20	(4.8)	7	2
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	0	0	0	0	0	0
Pheasant	5	57	57	.9	8	6
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	2	8	9	(.8)	81	8
Dove	0	0	1	(1.8)	9	0
Small-game total	25	283	476	5.7	-	-
				Acres		
Waterfowl total	2	17	26	568	97	13

Sub-Region A Total

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	120	806	1,034	26.1	202	32.8
Bear	7	43	50	(26.1)	6.4	1.5
Big-game total	127	849	1,084	26.1	-	-
Forest Small-game						
Grouse	50	611	806	26.1	1,169	174
Hare	27	321	344	(26.1)	474	136.5
Squirrel	6	75	91	(26.1)	88	21
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	.1	1	1	(.1)	18	6
Pheasant	23	266	312	4.1	46	34
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	8	37	41	(4)	423	43
Dove	0	0	3	(3.7)	18	0
Small-game total	114.1	1,311	1,598	30.2	-	-
				Acres		
Waterfowl total	10	79	94	900	288	57

Table 0-3 (Cont.) ----- Basin No. B-6

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	52	348	350	2.8	30	7
Bear	4	25	25	(2.8)	.6	.2
Big-game total	56	373	375	2.8	-	-
Forest Small-game						
Grouse	24	294	324	2.8	126	18
Hare	14	163	197	(2.8)	34	8
Squirrel	4	45	46	(2.8)	23	6
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	.5	6	6	(.3)	6	2
Pheasant	12	148	183	.9	13	9
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	5	21	47	(.5)	104	6
Dove	0	0	2	(1.6)	11	0
Small-game total	59.5	677	805	3.7	-	-
				Acres		
Waterfowl total	5	37	52	118	63	10

Basin No. B-7

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	48	317	317	3.6	16	5
Bear	8	52	62	(2.8)	.3	.1
Big-game total	56	369	379	3.6	-	-
Forest Small-game						
Grouse	16	190	190	3.6	107	18
Hare	9	106	106	(3.6)	13	4
Squirrel	4	49	49	(3.6)	17	6
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	4	48	50	(.8)	44	15
Pheasant	13	160	168	1.4	11	8
Quail	1	10	10	(.3)	3	1
Migratory Birds						
Woodcock	7	32	42	(.4)	105	8
Dove	0	0	3	(1.8)	17	0
Small-game total	54	595	618	5	-	-
				Acres		
Waterfowl total	5	43	43	44	71	18

Table 0-3 (Cont.) ----- Basin No. B-8

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	61	407	407	7.4	126	13
Bear	7	44	69	(4.2)	2	.1
Big-game total	68	451	476	7.4	-	-
Forest Small-game						
Grouse	15	178	204	7.4	375	49
Hare	13	161	179	(7.4)	94	28
Squirrel	16	187	189	(7.4)	156	68
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	15	179	191	(2.8)	257	86
Pheasant	12	148	148	3.8	60	45
Quail	1	6	6	(.5)	6	2.4
Migratory Birds						
Woodcock	9	38	38	(.5)	161	27
Dove	0	0	4	(2.7)	33	0
Small-game total	81	897	959	11.2	-	-
				Acres		
Waterfowl total	8	59	59	108	123	47

Basin No. B-9

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	8	52	60	3	5	.6
Bear	0	0	0	0	0	0
Big-game total	8	52	60	3	-	-
Forest Small-game						
Grouse	23	283	321	3	173	28
Hare	9	106	106	(2.2)	34	15
Squirrel	11	132	133	(3)	68	32
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	22	267	276	(.8)	188	77
Pheasant	27	331	334	1.6	60	44
Quail	4	53	53	(.6)	26	11
Migratory Birds						
Woodcock	17	76	93	(.5)	121	11
Dove	3	18	24	(1.7)	622	44
Small-game total	116	1,266	1,340	4.6	-	-
				Acres		
Waterfowl total	19	157	195	353	325	11

Table 0-3 (Cont.) ----- Basin No. B-10

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	3	21	39	2.9	8	.5
Bear	0	0	0	0	0	0
Big-game total	3	21	39	2.9	-	-
Forest Small-game						
Grouse	8	100	100	2.9	181	33
Hare	3	41	42	(2.2)	40	14
Squirrel	17	201	201	(2.9)	127	63
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	15	181	182	(1)	206	73
Pheasant	11	138	138	1.7	49	34
Quail	.3	3	3	(.1)	4	2
Migratory Birds						
Woodcock	5	23	43	(.5)	174	19
Dove	1	7	51	(3.1)	92	11
Small-game total	60.3	694	760	4.6	-	-
				Acres		
Waterfowl total	5	40	92	188	130	34

Sub-Region B Total

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	172	1,145	1,173	19.7	185	26.1
Bear	19	121	159	(9.8)	2.9	.4
Big-game total	191	1,266	1,329	19.7	-	-
Forest Small-game						
Grouse	86	1,045	1,139	19.7	962	146
Hare	48	577	630	(18.2)	215	69
Squirrel	52	614	618	(19.7)	391	175
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	56.5	681	705	(5.7)	701	253
Pheasant	75	925	971	9.4	193	140
Quail	6.3	72	72	(1.5)	39	16.4
Migratory Birds						
Woodcock	43	190	263	(2.4)	665	71
Dove	4	25	84	(10.9)	775	55
Small-game total	370.8	4,129	4,482	29.1	-	-
				Acres		
Waterfowl total	42	336	441	811	712	120

Table 0-3 (Cont.) ----- Basin No. C-11

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	72	500	909	7.1	154	18
Bear	12	55	55	(7.1)	2	.4
Big-game total	84	555	964	7.1	-	-
Forest Small-game						
Grouse	23	273	305	7.1	575	88
Hare	27	321	351	(7.1)	321	87
Squirrel	28	339	339	(7.1)	238	103
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	32	388	557	5	194	48
Pheasant	19	230	230	(2.9)	11	7
Quail	0	0	0	0	0	0
Migratory Birds						
Woodcock	11	44	50	(.9)	139	18
Dove	0	0	17	(2.2)	109	0
Small-game total	140	1,595	1,849	12.1	-	-
				Acres		
Waterfowl total	5	31	32	247	79	24

Basin No. C-12

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	38	250	418	6.4	143	16
Bear	6	38	38	(6.4)	1.3	.2
Big-game total	44	288	456	6.4	-	-
Forest Small-game						
Grouse	15	177	177	6.4	515	111
Hare	4	48	48	(6.4)	82	25
Squirrel	13	155	157	(6.4)	413	164
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	18	220	220	(3.7)	240	162
Pheasant	19	224	231	3.9	100	-
Quail	.2	2	2	(.2)	5	2
Migratory Birds						
Woodcock	23	93	106	(.9)	289	19
Dove	0	0	26	(4.1)	162	0
Small-game total	92.2	919	967	10.3	-	-
				Acres		
Waterfowl total	11	86	86	54	168	72

Table 0-3 (Cont.) ----- Basin No. C-13

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	0	0	50	.3	4	0
Bear	0	0	0	0	0	0
Big-game total	0	0	50	.3	-	-
Forest Small-game						
Grouse	15	181	181	(.3)	13	2
Hare	0	0	0	0	0	0
Squirrel	13	159	159	.6	120	82
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	19	226	226	.4	310	112
Pheasant	19	230	230	(.4)	58	37
Quail	2	18	18	(.2)	20	8
Migratory Birds						
Woodcock	14	54	54	(.05)	20	8
Dove	0	0	8	(1)	49	0
Small-game total	82	868	876	1	-	-
				Acres		
Waterfowl total	34	146	149	188	280	118

Sub-Region C Total

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	110	750	1,377	13.8	301	34
Bear	18	93	93	(13.5)	3.3	.6
Big-game total	128	843	1,470	13.8	-	-
Forest Small-game						
Grouse	53	631	663	(13.8)	1,103	201
Hare	31	369	399	(13.5)	403	112
Squirrel	54	653	655	14.1	771	349
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	69	834	1,003	9.3	744	322
Pheasant	57	684	691	(7.2)	169	44
Quail	2.2	20	20	(.4)	25	10
Migratory Birds						
Woodcock	48	191	210	(1.85)	448	45
Dove	0	0	51	(7.3)	320	0
Small-game total	314.2	3,382	3,692	23.4	-	-
				Acres		
Waterfowl total	50	263	267	489	527	214

Table 0-3 (Cont.) ----- Basin No. D-14

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	50	336	207	.8	18	4.5
Bear	0	0	0	0	0	0
Big-game total	50	336	207	.8	-	-
Forest Small-game						
Grouse	12	142	146	1	80	31
Hare	0	0	0	0	0	0
Squirrel	13	162	174	(1)	159	76
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	24	289	301	(1.1)	277	136
Pheasant	24	287	294	1.1	118	76
Quail	11	136	136	(1.1)	32	17
Migratory Birds						
Woodcock	8	32	65	(.3)	136	17
Dove	0	0	52	(1.9)	103	0
Small-game total	92	1,048	1,168	2.1	-	-
				Acres		
Waterfowl total	10	80	51	24	68	28

Basin No. D-15

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	270	1,798	1,798	5.2	126	31
Bear	28	183	229	(4)	.4	.08
Big-game total	298	1,981	2,027	5.2	-	-
Forest Small-game						
Grouse	53	591	606	5.2	265	39
Hare	1	12	11	(4)	14	5
Squirrel	100	1,205	1,272	(5.2)	458	199
Turkey	8	16	16	(4)	5	.7
Farm Small-game						
Cottontail	121	1,468	1,556	6.4	1,333	465
Pheasant	121	1,462	1,490	(6.4)	468	263
Quail	14	163	214	(5.6)	179	54
Migratory Birds						
Woodcock	15	60	65	(.9)	249	23
Dove	10	79	124	(9.9)	636	81
Small-game total	443	5,056	5,354	11.6	-	-
				Acres		
Waterfowl total	29	233	213	346	614	213

Table 0-3 (Cont.) ----- Basin No. D-16

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	20	135	270	.7	11	1
Bear	0	0	0	0	0	0
Big-game total	20	135	270	.7	-	-
Forest Small-game						
Grouse	4	53	159	.7	22	1
Hare	0	0	0	0	0	0
Squirrel	5	63	63	(.7)	60	34
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	9	114	118	(1)	278	107
Pheasant	9	111	111	1	70	53
Quail	5	55	62	(1)	83	52
Migratory Birds						
Woodcock	7	30	30	(.5)	246	28
Dove	0	0	66	(2)	127	0
Small-game total	39	426	609	1.7	-	-
				Acres		
Waterfowl total	9	75	104	291	360	55

Sub-Region D Total

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	340	2,269	2,275	6.7	155	36.5
Bear	28	183	229	(4)	.4	.08
Big-game total	368	2,452	2,504	6.7	-	-
Forest Small-game						
Grouse	69	786	911	6.9	367	71
Hare	1	12	11	(4)	14	5
Squirrel	118	1,430	1,509	(6.9)	677	309
Turkey	8	16	16	(4)	5	.7
Farm Small-game						
Cottontail	154	1,871	1,975	8.5	1,888	708
Pheasant	154	1,860	1,895	(8.5)	656	392
Quail	30	354	412	(7.7)	294	123
Migratory Birds						
Woodcock	30	122	160	(1.7)	631	68
Dove	10	79	242	(13.8)	866	81
Small-game total	574	6,530	7,131	15.4	-	-
				Acres		
Waterfowl total	48	388	368	661	1,042	296

Table 0-3 (Cont.) ----- Basin No. E-17

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	299	1,997	2,674	14.2	294	59
Bear	36	241	263	(14.2)	1	.2
Big-game total	335	2,238	2,937	14.2	-	-
Forest Small-game						
Grouse	68	744	781	14.2	721	122
Hare	4	44	32	(14.2)	70	29
Squirrel	120	1,202	1,436	(14.2)	853	306
Turkey	14	30	30	(14.2)	56	8
Farm Small-game						
Cottontail	136	1,361	1,701	11.7	871	251
Pheasant	144	1,439	1,523	(11.7)	197	103
Quail	4	42	67	(8.4)	23	5
Migratory Birds						
Woodcock	10	38	95	(1)	163	6
Dove	16	130	210	(12.8)	303	23
Small-game total	516	5,030	5,875	25.9	-	-
				Acres		
Waterfowl total	20	98	98	69	173	13

Basin No. E-18

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	40	264	320	2.8	28	4
Bear	0	0	0	0	0	0
Big-game total	40	264	320	2.8	-	-
Forest Small-game						
Grouse	0	0	0	0	0	0
Hare	0	0	0	0	0	0
Squirrel	51	535	547	6.1	804	392
Turkey	0	0	0	0	0	0
Farm Small-game						
Cottontail	30	314	322	2	683	271
Pheasant	14	137	137	(2)	65	40
Quail	17	184	189	(2)	369	144
Migratory Birds						
Woodcock	6	26	53	(1.5)	180	8
Dove	17	136	152	(7.2)	712	195
Small-game total	135	1,332	1,400	8.1	-	-
				Acres		
Waterfowl total	26	138	188	725	1,953	100

Table 0-3 (Cont.) ----- Sub-Region E Total

	Use		Supply	Resource Estimates		
				Sq. Mile		
	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	339	2,261	2,994	17	322	63
Bear	36	241	263	(14.2)	1	.2
Big-game total	375	2,502	3,257	17	-	-
Forest Small-game						
Grouse	68	744	781	(14.2)	721	122
Hare	4	44	32	(14.2)	70	29
Squirrel	171	1,737	1,983	20.3	1,657	698
Turkey	14	30	30	(14.2)	56	8
Farm Small-game						
Cottontail	166	1,675	2,023	13.7	1,554	522
Pheasant	158	1,576	1,659	(13.7)	262	143
Quail	21	226	256	(10.4)	392	149
Migratory Birds						
Woodcock	16	64	148	(2.5)	343	14
Dove	33	266	362	(20)	1,015	218
Small-game total	651	6,362	7,274	34	-	-
				Acres		
Waterfowl total	46	236	286	794	2,126	113

Basin No. F-19

	Hunters	Man-days	Man-days	Habitat	Population	Harvest
Big-game						
Deer	148	989	1,225	6.6	147	21
Bear	10	69	103	(3.9)	.3	.04
Big-game total	158	1,058	1,328	6.6	-	-
Forest Small-game						
Grouse	23	237	230	(6.6)	195	31
Hare	1	8	8	(2.7)	10	3
Squirrel	100	1,004	1,022	8.8	1,079	568
Turkey	10	45	46	(6.6)	18	2.9
Farm Small-game						
Cottontail	60	647	674	5	966	360
Pheasant	14	139	143	(3)	122	67
Quail	45	454	490	(5)	546	219
Migratory Birds						
Woodcock	11	43	43	(1)	121	13
Dove	26	213	269	(12)	1,145	238
Small-game total	290	2,790	2,925	13.8	-	-
				Acres		
Waterfowl total	15	88	61	74.5	179	47

Table 0-3 (Cont.) ----- Basin No. F-20

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	29	193	193	2.7	30	4.6
Bear	3	18	27	(2.1)	.2	.02
Big-game total	32	211	220	2.7	-	-
Forest Small-game						
Grouse	3	35	70	2.7	78	7
Hare	0	0	0	0	0	0
Squirrel	26	311	320	(2.7)	266	144
Turkey	1	2	2	(2.1)	1.4	.2
Farm Small-game						
Cottontail	15	175	164	(2.8)	187	87
Pheasant	0	0	0	0	0	0
Quail	15	175	210	2.9	180	69
Migratory Birds						
Woodcock	0	0	37	(.8)	104	0
Dove	7	57	217	(5.7)	871	58
Small-game total	67	755	1,020	5.6	-	-
				Acres		
Waterfowl total	5	32	41	192.6	99	14

Basin No. F-21

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	66	442	442	5.1	70	10
Bear	9	54	54	(5.1)	.3	.1
Big-game total	75	496	496	5.1	-	-
Forest Small-game						
Grouse	7	78	138	5.1	151	13
Hare	0	0	0	0	0	0
Squirrel	60	728	879	(5.1)	856	338
Turkey	4	8	8	(4)	15	2
Farm Small-game						
Cottontail	34	413	435	4.3	532	202
Pheasant	0	0	0	0	0	0
Quail	34	413	490	(4.3)	460	161
Migratory Birds						
Woodcock	0	0	47	(1)	135	0
Dove	16	131	137	(10)	1,544	135
Small-game total	155	1,771	2,134	9.4	-	-
				Acres		
Waterfowl total	7	56	58	180.5	82	24

Table 0-3 (Cont.) ----- Sub-Region F Total

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game						
Deer	243	1,624	1,860	14.4	247	35.6
Bear	22	141	184	(11.1)	.8	.16
Big-game total	265	1,765	2,044	14.4	-	-
Forest Small-game						
Grouse	33	350	438	(14.4)	424	51
Hare	1	8	8	(2.7)	10	3
Squirrel	186	2,043	2,221	16.6	2,201	1,050
Turkey	15	55	56	(12.7)	34.4	5.1
Farm Small-game						
Cottontail	109	1,235	1,273	(12.1)	1,685	649
Pheasant	14	139	143	(3)	122	67
Quail	94	1,042	1,190	12.2	1,186	449
Migratory Birds						
Woodcock	11	43	127	(2.8)	360	13
Dove	49	401	623	(27.7)	3,560	431
Small-game total	512	5,316	6,079	28.8	-	-
				Acres		
Waterfowl total	27	176	160	448	360	85

TABLE O-4

NAR SUMMARY OF HUNTER USE AND OPPORTUNITY
AND THE EXTENT OF HABITAT FOR GAME SPECIES - 1965

(Figures in thousands)

	Use		Supply	Resource Estimates		
	Hunters	Man-days	Man-days	Sq. Mile Habitat	Population	Harvest
Big-game total	1,454	9,677	11,638	97.7	1,427	231
Forest Small-game	1,095	12,151	13,341	103.7	11,812	3,736
Farm Small-game	1,190	13,461	14,601	57.0	9,974	4,086
Migratory Small-game	252	1,418	2,314	1/	9,424	1,039
Small-game total	2,537	27,030	30,256	160.7	31,210	8.861
				Acres		
Waterfowl	223	1,478	1,616	4,101	5,113	885

1/ Habitat for migratory small-game birds overlaps with big-game, other small-game, and waterfowl habitats and is, therefore, not additive.

area for that species is encompassed by that which is not in parenthesis in connection with these species indicates that their habitat in all cases is included within the figures given for one or another of the other game categories.

Table 0-5 summarizes the amount of other recreational use related to wildlife resources, i.e., the so-called "non-consumptive" uses, in the base year 1965. This Table includes no estimate of the 1965 capability of wildlife resources for meeting these needs. It is obvious, however, that certain happendings related to urbanization, such as elimination of open space and periodic spraying to control certain insects, have reduced the variety and abundance of wildlife resources far below the desirable level for a reasonably satisfactory human environment.

Sport Fisheries

Tables 0-6 and 0-7 summarize the status of the various categories of sport fisheries in terms of fishing area available (exclusive of salt-water), fishing opportunities which the resources can provide (supply), and the number of man-days of fishing recreation which occured in the base year, 1965. Broadly speaking, the capability of the resources available for use was still adequate, Regionwide, to meet needs in 1965, although shortages were evident in Sub-region E warm-water fisheries, and in all fresh-water categories in Sub-region F. Salt-water game-fish supply was found to be adequate throughout the North Atlantic Region. The outstanding shortage of sport-fishing opportunity occured in the estuarine sector of the anadromous fish category. These tables carry an estimate of the present (1965) latent demand for this type of fishing opportunity; such demand represents a need which, for the Region as a whole, exceeds 1.6 million man-days, annually.

Commercial Fisheries

Table 0-8 summarizes the harvest of estuarine-dependent species by States within the North Atlantic Region for the base year, 1965. These figures are redistributed in Table 0-9 to show "Use" by Basins. Table 0-9 also provides an estimate of the available supply of these resources as of 1965. Derivation of these figures as well as of other supply and use information is covered in Attachment 0-1 at the end of this Appendix.

TABLE O-5
NON-CONSUMPTIVE USE OF FISH AND WILDLIFE RESOURCES - 1965
(Figures in thousands)

Basin	Population	Basin-wide man-days	SMSA 1/ man-days	Total man-days
A-1	109	137	-	137
2	163	205	-	205
3	137	172	-	172
4	160	201	-	201
5	164	206	-	206
Sub-Region A	733	921	-	921
B-6	482	606	-	606
7	990	1,245	-	1,245
8	1,712	2,154	-	2,154
9	4,719	2,529	3,407	5,936
10	2,170	2,730	-	2,730
Sub-Region B	10,073	9,264	3,407	12,671
C-11	558	702	-	702
12	1,888	2,375	-	2,375
13	11,213	- 2/	14,107	14,107
Sub-Region C	13,659	3,077	14,107	17,184
D-14	3,565	572	3,913	4,485
15	6,954	3,022	5,726	8,748
16	1,309	1,647	-	1,647
Sub-Region D	11,828	5,241	9,639	14,880
E-17	3,442	4,330	-	4,330
18	2,242	358	2,462	2,820
Sub-Region E	5,684	4,688	2,462	7,150
F-19	3,522	1,402	3,028	4,430
20	373	469	-	469
21	1,748	2,200	-	2,200
Sub-Region F	5,643	4,071	3,028	7,099
N.A.R. TOTAL	47,620	27,262	32,643	59,905

1/ Standard Metropolitan Statistical Areas with a minimum population of one million people.

2/ Entire basin considered a Standard Metropolitan Statistical Area.

TABLE 0-6

FISHING RECREATION (USE), FISHING OPPORTUNITIES (SUPPLY) AND SURFACE ACRES OF HABITAT (EXCEPT FOR SALT-WATER) - 1965
(Figures in thousands)

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply[1/]	Use
A-1	109	41	746	Streams			
				Coldwater	18	180	30
				Lakes			
				Coldwater	91	1,365	716
				Total Freshwater	109	1,545	746
A-2	163	57	1,053	Streams			
				Coldwater	111	555	22
				Warmwater	22	89	11
				Lakes			
				Coldwater	210	3,150	526
				Warmwater	43	645	494
				Total Freshwater	386	4,439	1,053
				Anadromous		6	55[2/]
A-3	137	40	744	Streams			
				Coldwater	4	36	15
				Warmwater	2	18	7
				Lakes			
				Coldwater	100	1,500	372
				Warmwater	67	670	350
				Total Freshwater	173	2,224	744
				Anadromous		3	186[2/]
A-4	160	45	825	Streams			
				Coldwater	6	62	16
				Warmwater	1	32	8
				Lakes			
				Coldwater	62	682	413
				Warmwater	17	952	388
				Total Freshwater	86	1,728	825
				Anadromous		2	205[2/]
A-5	164	101	1,692	Streams			
				Coldwater	18	90	19
				Warmwater	7	28	10
				Lakes			
				Coldwater	178	1,953	484
				Warmwater	140	842	454
				Total Freshwater	343	2,913	967
				Anadromous		161	265
				Saltwater		3,491	460
TOTAL SUB-REGION A	733	284	5,060	Streams			
				Coldwater	157	923	102
				Warmwater	32	167	36
				Lakes			
				Coldwater	641	8,650	2,511
				Warmwater	267	3,109	1,686
				Total Freshwater	1,097	12,849	4,335
				Anadromous		161	265
				Saltwater		3,491	460
				Anadromous		11	446[2/]

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

2/ Latent demand represents use in estuarine area.

TABLE 0-6 Continued

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply[1/]	Use
B-6	482	246	4,188	Streams			
				Coldwater	1	295	66
				Warmwater	8	370	33
				Lakes			
				Coldwater	53	7,893	1,659
				Warmwater	24	1,560	1,560
				Total Freshwater	86	10,118	3,318
				Saltwater		3,264	870
				Anadromous		2	371[1/]
B-7	990	143	2,625	Streams			
				Coldwater	4	709	709
				Warmwater	8	256	131
				Lakes			
				Coldwater	79	7,678	551
				Warmwater	51	2,559	1,234
				Total Freshwater	142	11,202	2,625
				Anadromous		30	138[2/]
B-8	1,712	200	3,674	Streams			
				Coldwater	6	972	972
				Warmwater	29	931	288
				Lakes			
				Coldwater	11	1,243	1,008
				Warmwater	64	3,590	1,332
				Total Freshwater	110	6,736	3,600
				Anadromous		120	74
B-9	4,719	686	10,055	Streams			
				Coldwater	1	620	620
				Warmwater	5	155	41
				Lakes			
				Coldwater	6	1,283	1,283
				Warmwater	54	2,996	2,193
				Total Freshwater	66	5,054	4,137
				Saltwater		22,193	5,918
				Anadromous		26	404[2/]
B-10	2,170	250	3,627	Streams			
				Coldwater	2	923	923
				Warmwater	4	147	147
				Lakes			
				Coldwater	5	566	566
				Warmwater	27	1,498	462
				Total Freshwater	38	3,134	2,098
				Saltwater		5,734	1,529
				Anadromous		31	177[2/]
TOTAL SUB-REGION B	10,073	1,525	24,169	Streams			
				Coldwater	14	3,519	3,290
				Warmwater	54	1,859	640
				Lakes			
				Coldwater	154	18,663	5,067
				Warmwater	220	12,203	6,781
				Total Freshwater	442	36,244	15,778
				Anadromous		120	74
				Saltwater		31,191	8,317
				Anadromous		99	1,090[2/]

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

2/ Latent demand represents use in estuarine area.

TABLE O-6 Continued

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply[1/]	Use
C-11	558	204	3,757	Streams			
				Coldwater	7	796	638
				Warmwater	35	1,052	603
				Lakes			
				Coldwater	42	3,726	603
				Warmwater	235	7,039	1,913
				Total Freshwater	319	12,613	3,757
C-12	1,888	148	2,528	Streams			
				Coldwater	7	760	387
				Warmwater	33	1,005	364
				Lakes			
				Coldwater	18	1,659	364
				Warmwater	104	3,134	1,160
				Total Freshwater	162	6,558	2,275
				Anadromous		157	253
C-13	11,213	1,098	15,100	Streams			
				Coldwater	1	377	306
				Warmwater	5	407	288
				Lakes			
				Coldwater	1	293	288
				Warmwater	8	918	918
				Total Freshwater	15	1,995	1,800
				Saltwater		50,000	13,300
				Anadromous		5	90[2/]
TOTAL SUB-REGION C	13,659	1,450	21,385	Streams			
				Coldwater	15	1,933	1,331
				Warmwater	73	2,464	1,255
				Lakes			
				Coldwater	61	5,678	1,255
				Warmwater	347	11,091	3,991
				Total Freshwater	496	21,166	7,832
				Anadromous		157	253
				Saltwater		50,000	13,300
				Anadromous		5	90[2/]

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.
2/ Latent demand represents use in estuarine area.

TABLE 0-6 Continued

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply 1/	Use
D-14	3,565	144	1,940	Streams			
				Coldwater	3	901	901
				Warmwater	7	249	83
				Lakes			
				Coldwater	8	650	445
				Warmwater	11	561	511
				Total Freshwater	29	2,361	1,940
				Anadromous		1	11 2/
D-15	6,954	456	9,121	Streams			
				Coldwater	7	2,442	1,930
				Warmwater	34	2,632	965
				Lakes			
				Coldwater	8	2,685	1,367
				Warmwater	43	4,346	3,859
				Total Freshwater	92	12,105	8,121
				Anadromous		345	350
				Saltwater		2,438	650
D-16	1,309	562	7,314	Streams			
				Coldwater	1	457	24
				Warmwater	6	494	33
				Lakes			
				Coldwater	3	83	78
				Warmwater	2	188	171
				Total Freshwater	9	1,222	306
				Anadromous		7	8
				Saltwater		26,250	7,000
TOTAL SUB-REGION D	11,828	1,162	18,375	Streams			
				Coldwater	11	3,800	2,855
				Warmwater	47	3,375	1,081
				Lakes			
				Coldwater	16	3,418	1,890
				Warmwater	56	5,095	4,541
				Total Freshwater	130	15,688	10,367
				Anadromous		352	358
				Saltwater		28,688	7,650
				Anadromous		1	11 2/

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

2/ Latent demand represents use in estuarine area.

TABLE 0-6 Continued

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply 1/	Use
E-17	3,442	422	7,764	Streams			
				Coldwater	15	5,702	3,103
				Warmwater	73	5,262	931
				Lakes			
				Coldwater	8	1,500	621
				Warmwater	42	4,225	3,103
				Total Freshwater	138	16,689	7,758
				Anadromous		40	6
E-18	2,242	350	6,129	Streams			
				Warmwater	2	53	1,444
				Lakes			
				Warmwater	17	737	2,079
				Total Freshwater	19	790	3,523
				Anadromous		588	203
				Saltwater		6,478	2,403
TOTAL SUB-REGION E	5,684	772	13,893	Streams			
				Coldwater	15	5,702	3,103
				Warmwater	75	5,315	2,375
				Lakes			
				Coldwater	8	1,500	621
				Warmwater	59	4,962	5,182
				Total Freshwater	157	17,479	11,281
				Anadromous		628	209
				Saltwater		6,478	2,403

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

TABLE 0-6 Continued

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)			
Basin	Population	Fishermen	Fishermen-Days	Fish Habitat Class	Surface area acres	Supply 1/	Use
F-19	3,522	412	7,452	Streams			
				Coldwater	2	29	283
				Warmwater	32	1,162	1,651
				Lakes			
				Warmwater	18	947	2,784
				Total Freshwater	52	2,138	4,718
				Anadromous		35	355
				Saltwater		4,033	2,379
F-20	373	53	1,028	Streams			
				Coldwater	1	3	6
				Warmwater	5	170	257
				Lakes			
				Warmwater	10	629	379
				Total Freshwater	15	802	642
				Anadromous		202	160
				Saltwater		1,119	226
F-21	1,748	236	4,066	Streams			
				Coldwater	1	21	107
				Warmwater	23	642	626
				Lakes			
				Warmwater	18	1,017	1,055
				Total Freshwater	42	1,680	1,788
				Anadromous		139	446
				Saltwater		2,114	1,832
TOTAL SUB-REGION F	5,643	701	12,546	Streams			
				Coldwater	3	53	396
				Warmwater	60	1,974	2,534
				Lakes			
				Warmwater	46	2,593	4,218
				Total Freshwater	109	4,620	7,148
				Anadromous		376	961
				Saltwater		7,266	4,437

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

TABLE O-7

SUMMARY OF NAR SPORT-FISHING STATUS

(Figures in thousands)

Human Population and Sport Fishery Use				Fishery Supply and Use (Man-days)		
Population 1965	Fisherman	Fisherman-Days	Fish Habitat Class	Surface area Acres	Supply 1/	Use
47,620	5,894	95,417	Streams			
			Coldwater	215	15,930	11,077
			Warmwater	341	15,154	7,921
			Lakes			
			Coldwater	880	37,909	11,344
			Warmwater	995	39,053	26,399
			Total Freshwater	2,432	108,046	56,728
			Anadromous		1,794	2,120
			Saltwater		127,114	36,567
			Anadromous		116	1,637 2/

1/ Supply is a measure of the capability of fishery resources to provide sport-fishing opportunities under 1965 environmental conditions.

2/ Latent demand.

TABLE 0-8

COMMERCIAL HARVEST OF ESTUARINE-DEPENDENT SPECIES - 1965

(Thousands of pounds)

	Alewives	Menhaden	Food Fish	Shellfish	Others 1/
Maine	3,103	-	253	3,909	1,509
N. H.	125	-	123	37	17
Mass.	6,935	9	1,403	2,933	59
R. I.	210	7	11,072	2,442	-
Conn.	24	4	1,480	435	-
New York	24	30,140	12,269	7,534	-
New Jersey	22	74,373	16,927	3,743	-
Delaware	-	46,498	453	955	-
Chesapeake Bay 2/	38,292	359,946	44,829	118,131	-
TOTAL NAR	48,738	510,977	88,809	140,119	1,585
C. Bay, Va.	36,200	351,613	36,589	66,917	-
C. Bay, Md.	2,092	8,333	8,240	51,214	-
TOTAL C. B.	38,292	359,946	44,829	118,131	

1/ Others are blood worms and sand worms.

2/ C. Bay, Va.	36,200	351,613	36,589	66,917	-
C. Bay, Md.	2,092	8,333	8,240	51,214	-
TOTAL C. B.	38,292	359,946	44,829	118.131	

TABLE 0-9

COMMERCIAL FISHERY SUPPLY AND USE OF ESTUARINE-DEPENDENT SPECIES - 1965

(Figures in thousands)

		Supply 1/		Use	
Sub-Region	Type of Resource	Pounds	$ Value	Pounds	$ Value
A	Finfish	5,039	155	3,359	103
	Shellfish	6,098	1,924	3,909	1,057
	Seaworms	2,264	1,661	1,509	1,207
B	Finfish	32,088	2,501	21,392	1,667
	Shellfish	11,482	6,142	5,847	3,081
	Seaworms	114	140	76	93
C	Finfish	63,650	3,111	42,433	2,074
	Shellfish	15,068	12,606	7,534	6,303
D	Finfish	207,410	6,436	138,273	4,291
	Shellfish	9,396	4,016	4,698	2,008
E&F	Finfish	343,230	11,132	443,067	10,120
	Shellfish	105,000	28,168	118,131	27,370
Total NAR	Finfish	651,417	23,335	648,524	18,255
	Shellfish	147,044	52,856	140,119	39,819
	Seaworms	2,378	1,801	1,585	1,300

1/ Supply is a measure of the capability of commercial fishery resources in terms of sustained yields under 1965 environmental conditions.

CHAPTER 2. DEMAND, SUPPLY AND NEEDS

HUNTING

Demand

A combination of factors was used in providing an estimate of the hunters utilizing the resources of the NAR. These methods are presented in Attachments 0-1 and 0-3 at the end of this Appendix.

For the purposes of projecting demand, it was assumed that the percent of the population that hunted in each basin would remain constant throughout the projection period. By applying these percentages to the projected population of each basin, the number of hunters at any future date was derived. The base year (1965) hunter totals included both non-resident and unlicensed hunters. The same relative proportion of each was included in projecting future demand; very possibly this has resulted in too conservative an estimate of future non-resident hunters, but not so much so as to seriously affect conclusions as to future demands and needs.

An estimate of demand related to individual species was also provided using a percentage breakdown of total hunter-days to man-days spent hunting individual species. These percentages were applied to the projected total demands.

The rates of hunter participation (man-days per hunter) were determined from averages provided in the 1965 National Survey of Fishing and Hunting. If specific information was available, it was used in place of the national averages.

The geographical point of origin of all hunters was not determined; those hunters, however, that crossed state lines were included in individual basins as non-residents. The non-residents were determined from statewide percentages and prorated among individual basins. Identifying the basin exchange of hunters within a state adds little to the analysis of hunting demand in the NAR, the reason being that hunters traveling to adjacent basins are compensated for by influx into the vacated areas.

It is recognized that most hunters, both in individual basins and in sub-regions, originate from metropolitan areas, but it is assumed that the effect of this "metropolitan" hunting pressure is reflected in estimates of hunters within all basin boundaries. Also, if future supplies could be maintained at levels equal to the demand in all areas, then it would be assumed further that those people who are now hunting in specific areas will continue to do so and the proportion originating from different geographical areas will remain about the same in the future.

If one of the planning objectives is to provide improved

quality and quantity of hunting opportunities in the vininity of metropolitan areas, we can assume that this excludes big-game hunting. The emphasis, therefore, should be placed on small-game and waterfowl hunting. To provide additional hunting in these classes, both habitat and game abundance must be improved beyond what they are presently capable of supporting in the way of satisfactory hunting recreation.

In providing additional hunting opportunities in close proximity to the metropolitan areas, we are attempting to satisfy those who at present do not hunt but would like to if given adequate opportunities and chance of success. By improving the quality and quantity of hunting opportunity in an attempt to provide for those persons not now engaged in the sport -- to satisfy the latent demand -- we will also be making the metropolitan environs more attractive to those persons who previously traveled further afield. These hunters might very well introduce additional pressure in the improved hunting areas. In addition, these locations are generally the areas that have the biggest problem in satisfying the demand that already exists. It is questionable if the hunting quality can be improved to the extent that additional needs can be met.

It would seem more logical to assume that providing supplies necessary to satisfy increased future demands within basins other than in the vicinity of metropolitan areas and attempting to no more than continue to meet existing demands near the large population centers would represent the preferable course of action in regard to the problems of satisfying hunting demand within the NAR.

Supply

Estimates of the present wildlife supply were presented in Table 0-3 in terms of individual species numbers and associated habitats. The criteria used in the determination of these estimates are presented in Attachment 0-1 at the end of this Appendix.

Using these estimates as a base, these figures were projected through the year 2020. This was accomplished by assuming that the present ratio of habitat to game population represents the balance that will continue through the projection years (carrying capacity and productivity will remain at their present levels). Estimates of future amounts of habitat were determined by using the projected percent change in land-use trends as indicated in the preliminary issue of Land Use and Water Area[1/] of the NAR.

These percentages were applied to the present habitat

1/ Economic Research Service, Forest Service and Soil Conservation Service, U.S. Department of Agriculture, January, 1968.

figures to arrive at habitat estimates for each projection period. Projection totals for migratory-game species could not be directly related to land-use trends. They were, therefore, determined on the basis of additional supporting information and judgment decisions. Wildlife habitat projections are given in Table O-10.

The species population totals for the projection years were obtained by applying the base year (1965) number of animals per square mile of range to the projected estimates of habitat.

Resource Capability

Projected wildlife supplies and their related habitat were converted to a man-days capability estimate in order to provide a method for comparing wildlife supplies with estimated demands. In other words, the man-days capability represents the number of man-days use the resource is capable of supporting. The procedures used to determine the base year (1965) figures were described previously.

The projected man-day capability figures, while still a product of resource population, habitat, and satisfaction levels, were adjusted depending on estimates of the available access and sustained yield.

For the purpose of this report, it is assumed that sustained yield refers to the average number of animals that can be harvested from a population year after year without affecting subsequent yield. These figures were determined by applying to each species population the estimated maximum percentage that could be harvested on a sustained yield basis.

It should also be noted that a given wildlife population will provide a man-days capability figure regardless of amount of hunter use at any given time. The reason is that the perpetuation of the species is dependent upon the balance between its total population and the habitat needed to support that population. In other words, the carrying capacity for a certain species in a given habitat is relatively a fixed number, to which the annual gain through reproduction is largely surplus. The species is, therefore, capable of supporting a predetermined number of man-days of hunting irrespective of any current demands.

Needs

Needs of people for recreational opportunities related to fish and wildlife resources were determined by developing estimates of supply and comparing those with anticipated demands. Table O-11 presents needs related to hunting wild animals which it is expected will develop under "without-the-project" conditions; i.e., they reflect only that capability provided by the population-habitat

TABLE O-10
WILDLIFE HABITATS IN THE NAR - 1965-2020
(Figures in thousands)

Basin	Year	Area				
		Square Miles				Acres
		Big Game	Small Game			Waterfowl
			Forest	Farm	Sub-total	
1	1965	6.6	6.6	.8	7.4	26
	1980	6.4	6.4	.7	7.1	25
	2000	7.0	7.0	.6	7.6	24
	2020	6.4	6.4	.5	6.9	23
2	1965	6.8	6.8	.9	7.7	199
	1980	7.1	7.1	.5	7.6	189
	2000	7.1	7.1	.3	7.4	180
	2020	6.8	6.8	.1	6.9	171
3	1965	5.0	5.0	1.0	6.0	89
	1980	5.0	5.0	.5	5.5	84
	2000	5.0	5.0	.2	5.2	79
	2020	5.0	5.0	.1	5.1	74
4	1965	2.9	2.9	.5	3.4	18
	1980	2.9	2.9	.3	3.2	17
	2000	2.9	2.9	.1	3.0	16
	2020	2.9	2.9	.1	3.0	15
5	1965	4.8	4.8	.9	5.7	568
	1980	4.8	4.8	.5	5.3	540
	2000	4.8	4.8	.4	5.2	513
	2020	4.8	4.8	.3	5.1	487
Sub-	1965	26.1	26.1	4.1	30.2	900
Region	1980	26.2	26.2	2.5	28.7	855
A	2000	26.8	26.8	1.6	28.4	812
Total	2020	25.9	25.9	1.1	27.0	770

Table 0-10 (Cont'd)

Basin	Year	Area: Square Miles: Big Game	Small Game: Forest	Small Game: Farm	Small Game: Sub-total	Acres: Waterfowl
6	1965	2.8	2.8	.9	3.7	118
	1980	2.8	2.8	.5	3.3	106
	2000	2.8	2.8	.3	3.1	95
	2020	2.8	2.8	.2	3.0	85
7	1965	3.6	3.6	1.4	5.0	44
	1980	3.6	3.6	1.0	4.6	42
	2000	3.6	3.6	.6	4.2	40
	2020	3.6	3.6	.4	4.0	38
8	1965	7.4	7.4	3.8	11.2	108
	1980	7.4	7.4	2.7	10.1	97
	2000	7.4	7.4	1.5	8.9	87
	2020	7.4	7.4	.8	8.2	78
9	1965	3.0	3.0	.8	3.8	353
	1980	3.0	3.0	.5	3.5	318
	2000	3.0	3.0	.4	3.4	286
	2020	2.0	2.0	.3	2.3	257
10	1965	2.9	2.9	1.7	4.6	188
	1980	2.9	2.9	1.1	4.0	169
	2000	2.9	2.9	.6	3.5	152
	2020	2.9	2.9	.4	3.3	137
Sub-	1965	19.7	19.7	9.4	29.1	811
Region	1980	19.7	19.7	6.7	26.4	732
B	2000	19.7	19.7	4.2	23.9	660
Total	2020	18.7	18.7	2.8	21.5	595

Table 0-10 (Cont'd)

Basin	Year	Area: Square Miles: Big Game	Small Game: Forest	Small Game: Farm	Small Game: Sub-total	Acres: Waterfowl
11	1965	7.1	7.1	5.0	12.1	247
	1980	8.2	8.2	4.0	12.2	235
	2000	8.2	8.2	3.0	11.2	223
	2020	8.2	8.2	2.4	10.6	212
12	1965	6.4	6.4	3.9	10.3	54
	1980	7.3	7.3	3.6	10.9	49
	2000	8.0	8.0	3.4	11.4	44
	2020	7.3	7.3	3.2	10.5	40
13	1965	.3	.6	.4	1.0	188
	1980	.3	.3	.3	.6	169
	2000	.3	.3	.2	.5	152
	2020	.3	.3	.2	.5	137
Sub-	1965	13.8	14.1	9.3	23.4	489
Region	1980	15.8	15.8	7.9	23.7	453
C	2000	16.5	16.5	6.6	23.1	419
Total	2020	15.8	15.8	5.8	21.6	389

Table 0-10 (Cont'd)

Basin	Year	Area				
		Square Miles				Acres
		Big Game	Small Game			Waterfowl
			Forest	Farm	Sub-total	
14	1965	.8	1.0	1.1	2.1	24
	1980	.7	.9	.6	1.5	21
	2000	.6	.7	.5	1.2	19
	2020	.4	.5	.3	.8	17
15	1965	5.2	5.2	6.4	11.6	346
	1980	5.2	5.2	5.4	10.6	311
	2000	4.7	4.7	4.8	9.5	280
	2020	4.2	4.2	4.0	8.2	252
16	1965	.7	.7	1.0	1.7	291
	1980	.7	.7	.7	1.4	262
	2000	.7	.7	.6	1.3	236
	2020	.7	.7	.5	1.2	212
Sub-	1965	6.7	6.9	8.5	15.4	661
Region	1980	6.6	6.8	6.7	13.5	594
D	2000	6.0	6.1	5.9	12.0	535
Total	2020	5.3	5.4	4.8	10.2	481

Table 0-10 (Cont'd)

Basin	Year	Area				
		Square Miles				Acres
		Big Game	Small Game			Waterfowl
			Forest	Farm	Sub-total	
17	1965	14.2	14.2	11.7	25.9	69
	1980	15.0	15.0	10.5	25.5	62
	2000	15.8	15.8	8.9	24.7	55
	2020	15.8	15.8	7.6	23.4	50
18	1965	2.8	6.1	2.0	8.1	725
	1980	3.6	6.6	1.5	8.1	616
	2000	3.2	6.0	1.0	7.0	524
	2020	2.9	5.6	.8	6.4	445
Sub-Region E Total	1965	17.0	20.3	13.7	34.0	794
	1980	18.6	21.6	12.0	33.6	678
	2000	19.0	21.8	9.9	31.7	579
	2020	18.7	21.4	8.4	29.8	495

Table 0-10 (Cont'd)

Basin	Year	Area: Square Miles: Big Game	Small Game: Forest	Small Game: Farm	Small Game: Sub-total	Acres: Waterfowl
19	1965	6.6	8.8	5.0	13.8	75
	1980	6.9	8.8	4.8	13.6	64
	2000	6.9	8.8	3.7	12.5	54
	2020	6.3	8.8	3.0	11.8	46
20	1965	2.7	2.7	2.9	5.6	193
	1980	2.7	2.7	2.5	5.2	139
	2000	2.9	2.9	2.0	4.9	118
	2020	2.9	2.9	1.5	4.4	118
21	1965	5.1	5.1	4.3	9.4	181
	1980	4.8	4.8	4.3	9.1	154
	2000	5.2	5.2	3.0	8.2	131
	2020	4.8	4.8	2.9	7.7	111
Sub-Region F Total	1965	14.4	16.6	12.2	28.8	448
	1980	14.4	16.3	11.6	27.9	357
	2000	15.0	16.9	8.7	25.6	303
	2020	14.0	16.5	7.4	23.9	275
NAR Total	1965	97.7	103.7	57.2	160.9	4,103
	1980	101.3	106.4	47.4	153.8	3,669
	2000	103.0	107.8	36.9	144.7	3,308
	2020	98.4	103.7	30.3	134.0	3,005

TABLE O-11

PROJECTED DEMAND AND SUPPLY ESTIMATES FOR WILDLIFE RESOURCES WITH INDICATED NEEDS (IN THOUSANDS) - 1980-2020

Sub-Region A

		1980				2000				2020			
	Game	Demand		Supply 1/ in	Needs in	Demand		Supply 1/ in	Needs in	Demand		Supply 1/ in	Needs in
Basin	Class	Hunters	Man-days	Man-days	Man-days	Hunters	Man-days	Man-days	Man-days	Hunters	Man-days	Man-days	Man-days
A-1	Big game	19	127	220	0	22	149	248	0	26	175	220	0
	Small game	17	197	204	0	20	226	209	17	23	263	192	71
	Waterfowl	2	12	5	7	2	14	5	9	2	16	4	12
A-2	Big game	38	254	267	0	45	297	267	30	52	347	251	96
	Small game	34	394	367	27	40	455	357	98	46	529	322	207
	Waterfowl	3	24	32	0	3	28	30	0	4	33	29	4
A-3	Big game	29	191	197	0	34	222	197	25	39	260	197	63
	Small game	24	275	218	57	28	320	207	113	32	373	203	170
	Waterfowl	2	18	12	6	3	21	11	10	3	24	10	14
A-4	Big game	25	163	210	0	28	189	210	0	33	222	210	12
	Small game	21	234	210	24	23	270	186	84	28	318	185	133
	Waterfowl	2	16	8	8	2	18	8	10	3	21	7	14
A-5	Big game	30	199	200	0	35	233	200	33	41	274	200	74
	Small game	25	288	457	0	30	336	446	0	34	394	435	0
	Waterfowl	2	19	25	0	3	22	23	0	3	26	22	4
Sub-Region A 2/	Big game	141	934	1,094	0	164	1,090	1,122	0	191	1,278	1,078	200
	Small game	121	1,388	1,456	0	141	1,607	1,405	202	163	1,877	1,337	540
	Waterfowl	11	89	82	7	13	103	77	26	15	120	72	48

1/ Based upon estimates of habitat according to land-use projections and correlated with resource population estimates.

2/ Because of balancing out among the basins and the fact that where supply exceeds demand there is no need, total needs for the Sub-region do not equal the sum of the needs of the individual basins.

TABLE 0-11 CONTINUED

Sub-Region B

Basin	Game Class	1980 Demand Hunters	1980 Demand Man-days	1980 Supply 1/ in Man-days	1980 Needs in Man-days	2000 Demand Hunters	2000 Demand Man-days	2000 Supply 1/ in Man-days	2000 Needs in Man-days	2020 Demand Hunters	2020 Demand Man-days	2020 Supply 1/ in Man-days	2020 Needs in Man-days
B-6	Big game	64	429	375	54	79	528	375	153	98	654	375	279
	Small game	62	702	700	2	76	865	659	206	94	1,071	636	435
	Waterfowl	5	42	50	0	6	52	45	7	8	64	39	25
B-7	Big game	65	435	379	56	81	544	379	165	101	673	379	294
	Small game	55	611	548	63	68	765	506	259	85	946	482	464
	Waterfowl	6	50	31	19	8	63	28	35	10	78	26	52
B-8	Big game	91	610	476	134	115	771	476	295	141	965	476	489
	Small game	97	1,077	832	245	122	1,363	736	627	151	1,706	671	1,035
	Waterfowl	11	84	30	54	13	107	26	81	17	134	24	110
B-9	Big game	9	61	60	1	11	75	60	15	14	92	60	32
	Small game	134	1,433	1,177	256	158	1,723	1,042	681	189	2,062	758	1,304
	Waterfowl	22	181	149	32	28	224	139	85	34	274	125	149
B-10	Big game	4	24	39	0	5	30	39	0	6	38	39	0
	Small game	64	720	623	97	82	928	534	394	103	1,170	479	691
	Waterfowl	6	45	28	17	7	58	24	34	9	73	22	51
Sub-Region B 2/	Big game	233	1,559	1,329	230	291	1,943	1,329	619	363	2,422	1,329	1,093
	Small game	412	4,543	3,880	663	506	5,644	3,477	2,167	622	6,955	3,026	3,929
	Waterfowl	50	402	288	114	62	504	262	242	78	623	236	387

1/ Based upon estimates of habitat according to land-use projections and correlated with resource population estimates.

2/ Because of balancing out among the basins and the fact that where supply exceeds demand there is no need, total needs for the Sub-region do not equal the sum of the needs of the individual basins.

TABLE O-11 CONTINUED

Sub-Region C

Basin	Game Class	1980 Demand Hunters	1980 Demand Man-days	1980 Supply 1/ in Man-days	1980 Needs in Man-days	2000 Demand Hunters	2000 Demand Man-days	2000 Supply 1/ in Man-days	2000 Needs in Man-days	2020 Demand Hunters	2020 Demand Man-days	2020 Supply 1/ in Man-days	2020 Needs in Man-days
	Big game	93	619	1,050	0	106	710	1,050	0	125	831	1,050	0
C-11	Small game	140	1,602	1,780	0	160	1,836	1,619	217	188	2,150	1,508	642
	Waterfowl	6	34	24	10	7	39	22	17	8	46	20	26
	Big game	47	311	503	0	57	378	546	0	68	455	503	0
C-12	Small game	98	981	971	10	114	1,137	985	152	132	1,324	910	414
	Waterfowl	12	93	36	57	14	113	32	81	17	136	30	106
	Big game	0	0	50	0	0	0	50	0	0	0	50	0
C-13	Small game	94	1,006	857	149	111	1,189	770	419	131	1,399	693	706
	Waterfowl	39	167	95	72	47	203	82	121	57	243	77	136
	Big game	140	930	1,603	0	163	1,088	1,646	0	193	1,286	1,603	0
Sub-Region	Small game	332	3,589	3,608	0	385	4,162	3,374	788	451	4,873	3,111	1,762
C 2/	Waterfowl	57	294	155	139	68	355	136	219	82	425	127	298

1/ Based upon estimates of habitat according to land-use projections and correlated with resource population estimates.

2/ Because of balancing out among the basins and the fact that where supply exceeds demand there is no need, total needs for the Sub-region do not equal the sum of the needs of the individual basins.

TABLE O-11 CONTINUED

Sub-Region D

Basin	Game Class	1980 Demand Hunters	1980 Demand Man-days	1980 Supply 1/ in Man-days	1980 Needs in Man-days	2000 Demand Hunters	2000 Demand Man-days	2000 Supply 1/ in Man-days	2000 Needs in Man-days	2020 Demand Hunters	2020 Demand Man-days	2020 Supply 1/ in Man-days	2020 Needs in Man-days
D-14	Big game	56	371	192	179	67	449	160	289	81	539	109	430
	Small game	101	1,150	334	316	120	1,374	662	712	143	1,632	468	1,164
	Waterfowl	11	88	43	45	13	106	40	66	16	128	34	94
D-15	Big game	309	2,062	2,027	35	390	2,601	1,909	692	486	3,246	1,700	1,546
	Small game	530	6,066	4,825	1,241	660	7,554	4,358	3,196	818	9,337	3,756	5,581
	Waterfowl	34	279	192	87	43	352	176	176	54	439	158	281
D-16	Big game	23	155	270	0	29	193	270	0	36	239	270	0
	Small game	45	473	485	0	54	573	452	121	65	689	435	254
	Waterfowl	11	87	90	0	13	108	81	27	17	134	72	62
Sub-Region D 2/	Big game	338	2,588	2,489	99	486	3,243	2,339	904	603	4,024	2,079	1,945
	Small game	676	7,689	6,144	1,545	834	9,501	5,472	4,029	1,026	11,658	1,659	6,999
	Waterfowl	56	454	325	129	69	566	297	269	87	701	264	437

1/ Based upon estimates of habitat according to land-use projections and correlated with resource population estimates.

2/ Because of balancing out among the basins and the fact that where supply exceeds demand there is no need, total needs for the Sub-region do not equal the sum of the needs of the individual basins.

TABLE O-11 CONTINUED

Sub-Regions E & F

		1980				2000				2020			
		Demand		Supply 1/ in	Needs in	Demand		Supply 1/ in	Needs in	Demand		Supply 1/ in	Needs in
Basin	Game Class	Hunters	Man-days	Man-days	Man-days	Hunters	Man-days	Man-days	Man-days	Hunters	Man-days	Man-days	Man-days
E-17	Big game	397	2,647	3,103	0	496	3,307	3,304	3	616	4,107	3,304	803
	Small game	569	5,548	5,736	0	711	6,929	5,447	1,482	883	8,608	5,051	3,557
	Waterfowl	23	116	51	65	29	145	46	99	36	180	41	139
E-18	Big game	45	299	415	0	56	370	382	0	68	456	332	124
	Small game	157	1,560	1,348	212	168	1,648	1,153	495	205	2,030	995	1,035
	Waterfowl	29	157	162	0	36	194	138	56	44	239	117	122
Sub-Region E 2/	Big game	442	2,946	3,524	0	552	3,677	3,686	0	684	4,563	3,636	927
	Small game	726	7,108	7,104	4	879	8,577	6,600	1,977	1,088	10,638	6,046	4,592
	Waterfowl	52	273	213	60	65	339	184	155	80	419	158	261
F-19	Big game	204	1,359	1,457	0	292	1,948	1,457	491	400	2,665	1,292	1,373
	Small game	306	2,940	2,895	45	438	4,167	2,710	1,457	598	5,688	2,471	3,217
	Waterfowl	19	114	44	70	28	164	38	126	38	224	31	193
F-20	Big game	38	252	220	32	49	329	240	89	63	421	240	181
	Small game	68	797	953	0	90	1,036	914	122	114	1,325	852	473
	Waterfowl	5	38	32	6	7	50	26	24	9	64	22	42
F-21	Big game	92	614	450	164	117	777	507	270	146	971	450	521
	Small game	168	1,908	2,050	0	213	2,412	1,842	570	265	3,018	1,738	1,280
	Waterfowl	9	70	33	37	11	88	28	60	14	110	23	87
Sub-Region F 2/	Big game	334	2,225	2,127	98	458	3,054	2,204	850	609	4,057	1,982	2,075
	Small game	542	5,645	5,898	0	741	7,615	5,466	2,149	977	10,031	5,061	4,970
	Waterfowl	33	222	109	113	46	302	92	210	61	398	76	322

1/ Based upon estimates of habitat according to land-use projections and correlated with resource population estimates.

2/ Because of balancing out among the basins and the fact that where supply exceeds demand there is no need, total needs for the Sub-region do not equal the sum of the needs of the individual basins.

TABLE 0-11 CONTINUED

TOTAL NORTH ATLANTIC REGION

	Game Class	1980 Demand Hunters	1980 Demand Man-days	1980 Supply 1/ in Man-days	1980 Needs in Man-days	2000 Demand Hunters	2000 Demand Man-days	2000 Supply 1/ in Man-days	2000 Needs in Man-days	2020 Demand Hunters	2020 Demand Man-days	2020 Supply 1/ in Man-days	2020 Needs in Man-days
TOTAL NAR	Big game	1,678	11,182	12,166	0	2,114	14,100	12,326	1,774	2,643	17,630	11,707	5,923
	Small game	2,809	29,962	28,090	1,872	3,486	37,106	25,794	11,312	4,327	46,032	23,240	22,792
	Waterfowl	259	1,734	1,172	562	323	2,169	1,048	1,121	403	2,686	933	1,753

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates.

base for a given species without the benefit of any devices[1/] which might be included in the NAR plan. The projected habitat base is consistent with land-use projection estimates.

FISHING

Recreational

Finfish

Demand for sport-fishing opportunities was obtained by expanding the estimates of use for the base year 1965 (Table 0-6) in keeping with incremental increases in human population between benchmark years. The estimates of fishing pressure on anadromous species largely represent latent demand, because of the grossly inadequate supply which presently characterizes this resource. Sport fishing demand projections are presented in Table 0-12.

The finfish supply potential to meet recreational demand which was used in determining needs was abstracted from Table 0-6, also. These supply estimates represent resource potentials based upon existing environmental and resource conditions, e.g., existing extent and degrees of water polution, present species composition and standing crops, existing harvests, and angler-satisfaction rates (success ratios). The only factors acting to limit maximum sustainable use of this supply potential are (1) the quantitative lack of fishermen in any given area and (2) the lack of adequate access to existing fisheries. Public access for fishermen must be provided if full use of the supply potential is to be realized; on the other hand, in any given locality it may be a number of years before demands for fishing opportunity increase to the point where sufficient numbers of fishermen will seek to use its fishery resources to fully utilize their potential even though access might be adequate.

The effect of future public access development on increasing resource capability for meeting demand was taken into account. The quantity of additional access to be provided during the several bench mark intervals was estimated on the basis that the states will continue to acquire and develop access sites at a rate similar to that of the past ten years. The estimated base-year (1965) and future recreational capabilities of NAR fisheries are recorded in Table 0-13 (by basin and Sub-region).

Predicted needs for sport-fishing opportunities are also given in Table 0-13; Table 0-14 summarizes sport fishing needs

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1/ A term used in the NAR Study to denote any means or measures for resolving a problem having to do with water or related land resources.

TABLE 0-12
PROJECTION DATA RELATIVE TO FISHING DEMAND - 1965-2020
(Figures in thousands)

	Population 1/				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
Basin	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
A-1	109	113	132	155	41	42	49	58	Streams				
									Coldwater	30	30	34	40
									Lakes				
									Coldwater	716	705	824	968
									Total Freshwater	746	735	858	1,008
									Anadromous		39	45	53
A-2	163	165	193	226	57	61	71	83	Streams				
									Coldwater	22	22	24	30
									Warmwater	11	11	12	15
									Lakes				
									Coldwater	526	532	623	729
									Warmwater	494	500	585	685
									Total Freshwater	1,053	1,065	1,244	1,459
									Anadromous		56	66	77
A-3	137	175	204	238	40	65	75	88	Streams				
									Coldwater	15	19	22	26
									Warmwater	7	10	11	13
									Lakes				
									Coldwater	372	476	554	647
									Warmwater	350	447	521	608
									Total Freshwater	744	952	1,108	1,294
									Anadromous		238	277	323
A-4	160	189	219	257	45	66	76	90	Streams				
									Coldwater	16	20	22	26
									Warmwater	8	10	11	13
									Lakes				
									Coldwater	413	486	563	660
									Warmwater	388	456	529	620
									Total Freshwater	825	972	1,125	1,319
									Anadromous		243	281	330
A-5	164	178	208	244	101	110	129	151	Streams				
									Coldwater	19	21	24	29
									Warmwater	10	10	12	14
									Lakes				
									Coldwater	484	525	613	719
									Warmwater	454	493	576	675
									Total Freshwater	967	1,049	1,225	1,437
									Anadromous	265	287	336	394
									Saltwater	460	500	584	685
Total A	733	820	956	1,112	284	344	400	470	Streams				
									Coldwater	102	112	126	151
									Warmwater	36	41	46	55
									Lakes				
									Coldwater	2,511	2,724	3,177	3,723
									Warmwater	1,686	1,896	2,211	2,588
									Total Freshwater	4,335	4,773	5,560	6,517
									Anadromous	265	863	1,005	1,177
									Saltwater	460	500	584	685

1/ Population projections may differ from other population figures utilized in this study because of use of different methodologies.

TABLE O-12 CONTINUED

Basin	Population 1965	Population 1980	Population 2000	Population 2020	Estimated Anglers 1965	Estimated Anglers 1980	Estimated Anglers 2000	Estimated Anglers 2020	Distribution of Sport Fisherman-days: Fish Habitat Class	Estimated Man-Days of Fishing: Use 1965	Demand 1980	Demand 2000	Demand 2020
B-6	482	547	673	834	246	302	372	460	Streams				
									Coldwater	66	76	92	114
									Warmwater	33	38	46	57
									Lakes				
									Coldwater	1,659	1,884	2,318	2,873
									Warmwater	1,560	1,771	2,179	2,700
									Total Freshwater	3,318	3,769	4,635	5,744
									Anadromous		419	515	638
									Saltwater	870	989	1,217	1,509
B-7	990	1,165	1,456	1,802	143	177	221	274	Streams				
									Coldwater	709	836	1,044	1,293
									Warmwater	131	155	193	239
									Lakes				
									Coldwater	551	650	812	1,005
									Warmwater	1,234	1,455	1,818	2,250
									Total Freshwater	2,625	3,096	3,867	4,787
									Anadromous		163	204	252
B-8	1,712	2,322	2,938	3,676	200	272	344	430	Streams				
									Coldwater	972	1,323	1,673	2,094
									Warmwater	288	392	496	620
									Lakes				
									Coldwater	1,008	1,372	1,735	2,171
									Warmwater	1,332	1,813	2,293	2,869
									Total Freshwater	3,600	4,900	6,197	7,754
									Anadromous	74	100	127	158
B-9	4,719	5,517	6,822	8,346	686	828	1,023	1,252	Streams				
									Coldwater	620	728	899	1,101
									Warmwater	41	48	60	73
									Lakes				
									Coldwater	1,283	1,504	1,860	2,275
									Warmwater	2,193	2,572	3,179	3,890
									Total Freshwater	4,137	4,852	5,998	7,339
									Anadromous		469	582	712
									Saltwater	5,918	6,897	8,529	10,434
B-10	2,170	2,476	3,176	4,017	250	302	387	490	Streams				
									Coldwater	923	1,049	1,346	1,702
									Warmwater	147	167	214	271
									Lakes				
									Coldwater	566	644	826	1,044
									Warmwater	462	524	673	851
									Total Freshwater	2,098	2,384	3,059	3,868
									Anadromous		203	261	330
									Saltwater	1,529	1,745	2,239	2,832
Total B	10,073	12,027	15,065	18,675	1,525	1,881	2,347	2,906	Streams				
									Coldwater	3,290	4,012	5,054	6,304
									Warmwater	640	800	1,009	1,260
									Lakes				
									Coldwater	5,067	6,054	7,551	9,368
									Warmwater	6,781	8,135	10,142	12,560
									Total Freshwater	15,778	19,001	23,756	29,492
									Anadromous	74	1,354	1,689	2,090
									Saltwater	8,317	9,631	11,985	14,775

TABLE 0-12 CONTINUED

	Population				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
Basin	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
C-11	558	622	713	835	204	227	260	305	Streams				
									Coldwater	638	710	814	953
									Warmwater	603	668	766	897
									Lakes				
									Coldwater	603	668	766	897
									Warmwater	1,913	2,130	2,442	2,860
									Total Freshwater	3,757	4,176	4,788	5,607
C-12	1,888	2,031	2,462	2,968	137	148	180	217	Streams				
									Coldwater	387	417	506	610
									Warmwater	364	393	476	574
									Lakes				
									Coldwater	364	393	476	574
									Warmwater	1,160	1,252	1,518	1,830
									Total Freshwater	2,275	2,455	2,976	3,588
									Anadromous	253	273	331	399
C-13	11,213	12,881	15,618	18,756	1,098	1,262	1,531	1,838	Streams				
									Coldwater	306	345	419	503
									Warmwater	288	325	394	473
									Lakes				
									Coldwater	288	325	394	473
									Warmwater	918	1,036	1,256	1,508
									Total Freshwater	1,800	2,031	2,463	2,957
									Anadromous		102	124	149
									Saltwater	13,300	15,247	18,487	22,201
Total C	13,659	15,534	18,793	22,559	1,439	1,637	1,971	2,360	Streams				
									Coldwater	1,331	1,472	1,739	2,066
									Warmwater	1,255	1,386	1,636	1,944
									Lakes				
									Coldwater	1,255	1,386	1,636	1,944
									Warmwater	3,991	4,418	5,216	6,198
									Total Freshwater	7,832	8,662	10,227	12,152
									Anadromous	253	375	455	548
									Saltwater	13,300	15,247	18,487	22,201

TABLE 0-12 CONTINUED

	Population				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
Basin	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
D-14	3,565	3,968	4,808	5,772	144	163	197	237	Streams				
									Coldwater	901	994	1,204	1,446
									Warmwater	83	86	105	126
									Lakes				
									Coldwater	445	497	602	723
									Warmwater	511	562	681	817
									Total Freshwater	1,940	2,139	2,592	3,112
									Anadromous		12	14	17
D-15	6,954	8,388	10,577	13,203	456	554	698	871	Streams				
									Coldwater	1,930	2,344	2,956	3,690
									Warmwater	965	1,172	1,478	1,845
									Lakes				
									Coldwater	1,367	1,660	2,094	2,613
									Warmwater	3,859	4,688	5,911	7,379
									Total Freshwater	8,121	9,864	12,439	15,527
									Anadromous	350	428	540	674
									Saltwater	650	781	985	1,229
D-16	1,309	1,492	1,865	2,305	562	642	802	991	Streams				
									Coldwater	24	28	35	43
									Warmwater	33	38	48	59
									Lakes				
									Coldwater	78	90	113	139
									Warmwater	171	198	247	305
									Total Freshwater	306	354	443	546
									Anadromous	8	9	11	13
									Saltwater	7,000	7,977	9,971	12,324
Total D	11,828	13,848	17,250	21,280	1,162	2,521	1,697	2,099	Streams				
									Coldwater	2,855	3,366	4,195	5,179
									Warmwater	1,081	1,296	1,631	2,030
									Lakes				
									Coldwater	1,890	2,247	2,809	3,475
									Warmwater	4,541	5,448	6,839	8,501
									Total Freshwater	10,367	12,357	15,474	19,185
									Anadromous	358	449	565	704
									Saltwater	7,650	8,758	10,956	13,553

TABLE O-12 CONTINUED

	Population				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
Basin	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
E-17	3,442	4,063	5,075	6,304	422	524	655	814	Streams				
									Coldwater	3,103	3,675	4,591	5,703
									Warmwater	931	1,102	1,377	1,711
									Lakes				
									Coldwater	621	735	918	1,141
									Warmwater	3,103	3,675	4,591	5,703
									Total Freshwater	7,758	9,187	11,477	14,258
									Anadromous	6	460	574	713
E-18	2,242	2,531	3,138	3,861	350	395	490	602	Streams				
									Warmwater	1,444	1,633	2,025	2,492
									Lakes				
									Warmwater	2,079	2,351	2,915	3,586
									Total Freshwater	3,523	3,984	4,940	6,078
									Anadromous	203	226	281	345
									Saltwater	2,403	2,717	3,368	4,144
Total E	5,684	6,594	8,213	10,165	772	919	1,145	1,416	Streams				
									Coldwater	3,103	3,675	4,591	5,703
									Warmwater	2,375	2,735	3,402	4,203
									Lakes				
									Coldwater	621	735	918	1,141
									Warmwater	5,182	6,026	7,506	9,289
									Total Freshwater	11,281	13,171	16,418	20,336
									Anadromous	209	686	855	1,058
									Saltwater	2,403	2,717	3,368	4,144

TABLE 0-12 CONTINUED

	Population				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
Basin	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
F-19	3,522	4,488	6,431	8,801	412	525	753	1,030	Streams				
									Coldwater	283	359	515	705
									Warmwater	1,651	2,097	3,004	4,111
									Lakes				
									Warmwater	2,784	3,534	5,064	6,931
									Total Freshwater	4,718	5,990	8,583	11,747
									Anadromous	355	451	646	884
									Saltwater	2,379	3,037	4,353	5,956
F-20	373	446	581	743	53	63	82	105	Streams				
									Coldwater	6	8	10	13
									Warmwater	257	308	402	514
									Lakes				
									Warmwater	379	455	594	759
									Total Freshwater	642	771	1,006	1,286
									Anadromous	160	193	252	322
									Saltwater	226	269	351	448
F-21	1,748	2,165	2,735	3,423	236	292	369	462	Streams				
									Coldwater	107	132	167	209
									Warmwater	626	771	974	1,220
									Lakes				
									Warmwater	1,055	1,299	1,643	2,056
									Total Freshwater	1,788	2,202	2,784	3,485
									Anadromous	446	552	697	871
									Saltwater	1,832	2,276	2,875	3,599
Total F	5,643	7,099	9,747	12,967	701	880	1,204	1,597	Streams				
									Coldwater	396	499	692	927
									Warmwater	2,534	3,176	4,380	5,845
									Lakes				
									Warmwater	4,218	5,288	7,301	9,746
									Total Freshwater	7,148	8,963	12,373	16,518
									Anadromous	961	1,196	1,595	2,077
									Saltwater	4,437	5,582	7,579	10,003

TABLE O-12 CONTINUED

TOTAL NAR

	Population				Estimated Anglers				Distribution of Sport Fisherman-days	Estimated Man-days of Fishing			
										Use	Demand		
	1965	1980	2000	2020	1965	1980	2000	2020	Fish Habitat Class	1965	1980	2000	2020
TOTAL NAR	47,620	55,922	70,024	86,758	5,883	8,182	8,764	10,529	Streams				
									Coldwater	11,077	13,136	16,397	20,330
									Warmwater	7,921	9,434	12,104	15,337
									Lakes				
									Coldwater	11,344	13,146	16,094	19,651
									Warmwater	26,399	31,211	39,215	48,882
									Total Freshwater	56,741	66,927	83,810	104,200
									Anadromous	2,120	4,923	6,164	7,654
									Saltwater	36,567	42,435	52,959	65,361

TABLE O-13. ESTIMATED RECREATIONAL FISHERY DEMAND, CAPABILITY AND NEEDS - 1965-2020

Sub-Region A

		Demand				Capability				Needs			
		Thousands of Man-Days				Thousands of Man-Days				Thousands of Man-Days			
Basin	Fish Habitat Class	1965	1980	2000	2020	1965	1980	2000	2020	1965	1980	2000	2020
A-1	Streams												
	Coldwater	30	30	34	40	30	40	54	62	0	0	0	0
	Lakes												
	Coldwater	716	705	824	968	716	963	1,300	1,365	0	0	0	0
	Total Freshwater	746	735	858	1,008	746	1,003	1,354	1,427	0	0	0	0
	Anadromous		39	45	53		-	-	-		39	45	53
A-2	Streams												
	Coldwater	22	22	24	30	22	27	34	41	0	0	0	0
	Warmwater	11	11	12	15	11	14	18	22	0	0	0	0
	Lakes												
	Coldwater	526	532	623	729	526	654	829	1,003	0	0	0	0
	Warmwater	494	500	585	685	494	615	780 1/	780 1/	0	0	0	0
	Total Freshwater	1,053	1,065	1,244	1,459	1,053	1,310	1,661	1,846	0	0	0	0
	Anadromous		56	66	77	6	31	36	41		25	30	36
A-3	Streams												
	Coldwater	15	19	22	26	15	20	27	34	0	0	0	0
	Warmwater	7	10	11	13	7	10	12	15	0	0	0	0
	Lakes												
	Coldwater	372	476	554	647	372	500	675	851	0	0	0	0
	Warmwater	350	447	521	608	350	471	636	670	0	0	0	0
	Total Freshwater	744	952	1,108	1,294	744	1,001	1,350	1,570	0	0	0	0
	Anadromous		238	277	323		3	3	3		235	274	320
A-4	Streams												
	Coldwater	16	20	22	26	16	21	28	35	0	0	0	0
	Warmwater	8	10	11	13	8	10	13	16	0	0	0	0
	Lakes												
	Coldwater	413	486	563	660	413	541	682	682	0	0	0	0
	Warmwater	388	456	529	620	388	508	671	832	0	0	0	0
	Total Freshwater	825	972	1,125	1,319	825	1,080	1,394	1,565	0	0	0	0
	Anadromous		243	281	330		2	2	2		241	279	328
A-5	Streams												
	Coldwater	19	21	24	29	19	24	31	40	0	0	0	0
	Warmwater	10	10	12	14	10	13	17	21	0	0	0	0
	Lakes												
	Coldwater	484	525	613	719	484	620	794	970	0	0	0	0
	Warmwater	454	493	576	675	454	581	744	842	0	0	0	0
	Total Freshwater	967	1,049	1,225	1,437	967	1,238	1,586	1,873	0	0	0	0
	Anadromous	265	287	336	394	161	224	249	278	104	63	87	116
	Saltwater	460	500	584	685	460	528	609	690	0	0	0	0
Sub-Region A	Streams												
	Coldwater	102	112	126	151	102	132	174	212	0	0	0	0
	Warmwater	36	41	46	55	36	47	60	74	0	0	0	0
	Lakes												
	Coldwater	2,511	2,724	3,177	3,723	2,511	3,278	4,280	4,871	0	0	0	0
	Warmwater	1,686	1,896	2,211	2,588	1,686	2,175	2,831	3,124 1/	0	0	0	0
	Total Freshwater	4,335	4,773	5,560	6,517	4,335	5,632	7,345	8,281	0	0	0	0
	Anadromous	265	863	1,005	1,177	167	260	290	324	98	603	715	853
	Saltwater	460	500	584	685	460	528	609	690	0	0	0	0

1/ Use made of marginal coldwater lakes

TABLE 0-13 (CONT.)

Sub-Region B

Basin	Fish Habitat Class	Demand (Thousands of Man-Days) 1965	1980	2000	2020	Capability (Thousands of Man-Days) 1965	1980	2000	2020	Needs (Thousands of Man-Days) 1965	1980	2000	2020
B-6	Streams												
	Coldwater	66	76	92	114	66	71	78	85		5	14	29
	Warmwater	33	38	46	57	33	36	39	43		2	7	14
	Lakes												
	Coldwater	1,659	1,884	2,318	2,873	1,659	1,792	1,971	2,148		92	347	725
	Warmwater	1,560	1,771	2,179	2,700	1,560	1,685 1/	1,854 1/	2,021 1/		86	325	679
	Total Freshwater	3,318	3,769	4,635	5,744	3,318	3,584	3,942	4,297		185	693	1,447
	Anadromous		419	515	638		75	93	116		344	422	522
	Saltwater	870	989	1,217	1,509	870	938	1,019	1,100		51	198	409
B-7	Streams												
	Coldwater	709	836	1,044	1,293	709	709	709	709		127	335	584
	Warmwater	131	155	193	239	131	144	161	177		11	37	62
	Lakes												
	Coldwater	551	650	812	1,005	551	606	679	760		44	133	245
	Warmwater	1,234	1,455	1,818	2,250	1,234	1,357	1,520	1,672		98	298	578
	Total Freshwater	2,625	3,096	3,867	4,787	2,625	2,816	3,069	3,318		280	798	1,469
	Anadromous		163	204	252		30	30	30		133	174	222
B-8	Streams												
	Coldwater	972	1,323	1,673	2,094	972	972	972	972		351	701	1,122
	Warmwater	288	392	496	620	288	308	336	363		84	160	257
	Lakes												
	Coldwater	1,008	1,372	1,735	2,171	1,008	1,079	1,176	1,243		293	559	928
	Warmwater	1,332	1,813	2,293	2,869	1,332	1,425	1,553	1,677		388	740	1,192
	Total Freshwater	3,600	4,900	6,197	7,754	3,600	3,784	4,037	4,255		1,116	2,160	3,499
	Anadromous	74	100	127	158	120	120	124	140			3	18
B-9	Streams												
	Coldwater	620	728	899	1,101	620	620	620	620		108	279	481
	Warmwater	41	48	60	73	41	43	46	49		5	14	24
	Lakes												
	Coldwater	1,283	1,504	1,860	2,275	1,283	1,283	1,283	1,283		221	577	992
	Warmwater	2,193	2,572	3,179	3,890	2,193	2,325	2,511	2,687		247	668	1,203
	Total Freshwater	4,137	4,852	5,998	7,339	4,137	4,271	4,460	4,639		581	1,538	2,700
	Anadromous		469	582	712		48	54	61		421	528	651
	Saltwater	5,918	6,897	3,529	10,434	5,918	5,986	6,067	6,148		911	2,462	4,286
B-10	Streams												
	Coldwater	923	1,049	1,346	1,702	923	923	923	923		126	423	779
	Warmwater	147	167	214	271	147	147	147	147		20	67	124
	Lakes												
	Coldwater	566	644	826	1,044	566	566	566	566		78	260	478
	Warmwater	462	524	673	851	462	517	595	672		7	78	179
	Total Freshwater	2,098	2,384	3,059	3,868	2,098	2,153	2,231	2,308		231	828	1,560
	Anadromous		203	261	330		40	43	47		163	218	283
	Saltwater	1,529	1,745	2,239	2,832	1,529	1,597	1,678	1,759		148	561	1,073
Sub-Region B	Streams												
	Coldwater	3,290	4,012	5,054	6,304	3,290	3,295	3,302	3,309		717	1,752	2,995
	Warmwater	640	800	1,009	1,260	640	678	729	779		122	280	481
	Lakes												
	Coldwater	5,067	6,054	7,551	9,368	5,067	5,326	5,675	6,000		728	1,876	3,368
	Warmwater	6,781	8,135	10,142	12,560	6,781	7,309	8,033	8,729		826	2,109	3,831
	Total Freshwater	15,778	19,001	23,756	29,492	15,778	16,608	17,739	18,817		2,393	6,017	10,675
	Anadromous	74	1,354	1,689	2,090	120	365	415	490		989	1,274	1,600
	Saltwater	8,317	9,631	11,985	14,775	8,317	8,521	8,764	9,007		1,110	3,221	5,768

1/ Use made of marginal coldwater lakes

TABLE 0-13 (CONT.)

Sub-Region C

Basin	Fish Habitat Class	Demand Thousands of Man-Days 1965	1980	2000	2020	Capability Thousands of Man-Days 1965	1980	2000	2020	Needs Thousands of Man-Days 1965	1980	2000	2020
C-11	Streams												
	Coldwater	638	710	814	953	638	683	744	796		27	70	157
	Warmwater	603	668	766	897	603	645	703	759		23	63	138
	Lakes												
	Coldwater	603	668	766	897	603	645	703	759		23	63	138
	Warmwater	1,913	2,130	2,442	2,860	1,913	2,047	2,231	2,409		83	211	451
	Total Freshwater	3,757	4,176	4,788	5,607	3,757	4,020	4,381	4,723		156	407	884
C-12	Streams												
	Coldwater	387	417	506	610	387	430	490	549		0	16	61
	Warmwater	364	393	476	574	364	404	461	516		0	15	58
	Lakes												
	Coldwater	364	393	476	574	364	404	461	516		0	15	58
	Warmwater	1,160	1,252	1,518	1,830	1,160	1,288	1,468	1,644		0	50	186
	Total Freshwater	2,275	2,455	2,976	3,588	2,275	2,526	2,880	3,225		0	96	363
	Anadromous	253	273	331	399	157	215	244	278	96	58	87	121
C-13	Streams												
	Coldwater	306	345	418	503	306	349	377	377		0	42	126
	Warmwater	288	325	394	473	288	328	384	407		0	10	66
	Lakes												
	Coldwater	283	325	394	473	288	293	293	293		32	101	180
	Warmwater	918	1,036	1,256	1,508	918	918	918	918		118	338	590
	Total Freshwater	1,800	2,031	2,463	2,957	1,800	1,888	1,972	1,965		150	491	962
	Anadromous		102	124	148		5	5	5		97	119	144
	Saltwater	13,300	15,247	18,487	22,201	13,300	13,368	13,449	13,530		1,879	5,038	8,671
Sub-Region C	Streams												
	Coldwater	1,331	1,472	1,739	2,066	1,331	1,462	1,611	1,722		10	128	344
	Warmwater	1,255	1,386	1,636	1,944	1,255	1,377	1,548	1,682		9	88	262
	Lakes												
	Coldwater	1,255	1,386	1,636	1,944	1,255	1,342	1,457	1,568		44	179	376
	Warmwater	3,991	4,418	5,216	6,198	3,991	4,253	4,617	4,971		165	599	1,231
	Total Freshwater	7,833	8,662	10,227	12,152	7,832	8.434	9,233	9,943		228	994	2,213
	Anadromous	253	375	455	548	157	220	249	283	95	155	206	265
	Saltwater	13,300	15,247	18,487	22,201	13,300	13,368	13,449	13,530		1,879	5,038	8,671

TABLE O-13 (CONT.)

Sub-Region D

Basin	Fish Habitat Class	Demand Thousands of Man-Days 1965	1980	2000	2020	Capability Thousands of Man-Days 1965	1980	2000	2020	Needs Thousands of Man-Days 1965	1980	2000	2020
D-14	Streams												
	Coldwater	901	994	1,204	1,446	901	901	901	901	0	93	303	545
	Warmwater	83	86	105	126	83	94	109	124	0	0	0	2
	Lakes												
	Coldwater	445	497	602	723	445	502	582	650	0	0	20	73
	Warmwater	511	562	681	817	511	561	561	561	0	1	120	256
	Total Freshwater	1,940	2,139	2,592	3,112	1,940	2,058	2,153	2,236	0	94	443	876
	Anadromous		12	14	17		6	7	9		6	7	8
D-15	Streams												
	Coldwater	1,930	2,344	2,956	3,690	1,930	1,988	2,068	2,130	0	356	888	1,560
	Warmwater	965	1,172	1,478	1,845	965	994	1,034	1,075	0	178	444	770
	Lakes												
	Coldwater	1,367	1,660	2,094	2,613	1,367	1,408	1,434	1,523	0	252	630	1,090
	Warmwater	3,859	4,688	5,911	7,379	3,859	3,975	4,134	4,299	0	713	1,777	3,080
	Total Freshwater	8,121	9,864	12,439	15,527	8,121	8,365	8,700	9,027	0	1,499	3,739	6,500
	Anadromous	350	428	540	674	345	387	443	510	5	41	97	164
	Saltwater	650	781	985	1,229	650	718	799	880	0	63	186	349
D-16	Streams												
	Coldwater	24	28	35	43	24	45	73	73	0	0	0	0
	Warmwater	33	38	48	59	33	61	99	99	0	0	0	0
	Lakes												
	Coldwater	78	90	113	139	78	83	83	83	0	7	30	56
	Warmwater	171	198	247	305	171	188	188	188	0	10	59	117
	Total Freshwater	306	354	443	546	306	377	443	443	0	17	89	173
	Anadromous	8	9	11	13	7	8	9	10	1	1	2	3
	Saltwater	7,000	7,977	9,971	12,324	7,000	7,068	7,149	7,230	0	909	2,822	5,094
Sub-Region D													
	Streams												
	Coldwater	2,855	3,366	4,195	5,179	2,855	2,934	3,042	3,104	0	432	1,153	2,075
	Warmwater	1,081	1,296	1,631	2,030	1,081	1,149	1,242	1,298	0	147	389	732
	Lakes												
	Coldwater	1,890	2,247	2,809	3,475	1,890	1,993	2,129	2,256	0	254	680	1,219
	Warmwater	4,541	5,448	6,839	8,501	4,541	4,724	4,883	5,048	0	724	1,956	3,453
	Total Freshwater	10,367	12,357	15,474	19,185	10,367	10,800	11,296	11,706	0	1,557	4,178	7,479
	Anadromous	358	449	565	704	353	401	459	529	5	48	102	175
	Saltwater	7,650	8,758	10,956	13,553	7,650	7,786	7,948	8,110	0	972	3,003	5,443

TABLE 0-13 (CONT.)

Sub-Region E

		Demand				Capability				Needs			
		Thousands of Man-Days				Thousands of Man-Days				Thousands of Man-Days			
Basin	Fish Habitat Class	1965	1980	2000	2020	1965	1980	2000	2020	1965	1980	2000	2020
E-17	Streams												
	Coldwater	3,103	3,675	4,591	5,703	3,103	3,196	3,324	3,457	0	479	1,267	2,246
	Warmwater	931	1,102	1,377	1,711	931	959	997	1,037	0	143	380	674
	Lakes												
	Coldwater	621	735	918	1,141	621	639	665	692	0	96	253	449
	Warmwater	3,103	3,675	4,591	5,703	3,103	3,196	3,324	3,457	0	479	1,267	2,246
	Total Freshwater	7,758	9,187	11,477	14,258	7,758	7,990	8,310	8,643	0	1,197	3,167	5,615
	Anadromous	6	460	574	713	40	250	307	377	0	210	267	336
E-18	Streams												
	Warmwater	1,444	1,633	2,025	2,492	53	53	53	53	1,391	1,580	1,972	2,439
	Lakes												
	Warmwater	2,079	2,351	2,915	3,586	737	737	737	737	1,342	1,614	2,178	2,849
	Total Freshwater	3,523	3,984	4,940	6,078	790	790	790	790	2,733	3,194	4,150	5,288
	Anadromous	203	226	281	345	203	270	361	451	0	0	0	0
	Saltwater	2,403	2,717	3,368	4,144	2,403	2,471	2,552	2,633	0	246	816	1,511
Sub-Region E	Streams												
	Coldwater	3,103	3,675	4,591	5,703	3,103	3,196	3,324	3,457	0	479	1,267	2,246
	Warmwater	2,375	2,735	3,402	4,203	984	1,012	1,050	1,090	1,391	1,723	2,352	3,113
	Lakes												
	Coldwater	621	735	918	1,141	621	639	665	692	0	96	253	449
	Warmwater	5,182	6,026	7,506	9,289	3,840	3,933	4,061	4,194	1,342	2,093	3,445	5,095
	Total Freshwater	11,281	13,171	16,417	20,336	8,548	8,780	9,100	9,433	2,733	4,391	7,317	10,903
	Anadromous	209	686	855	1,058	243	520	668	828	0	166	187	230
	Saltwater	2,403	2,717	3,368	4,144	2,403	2,471	2,552	2,633	0	246	816	1,511

TABLE O-13 (CONT.)

Sub-Region F

Basin	Fish Habitat Class	Demand: Thousands of Man-Days 1965	1980	2000	2020	Capability: Thousands of Man-Days 1965	1980	2000	2020	Needs: Thousands of Man-Days 1965	1980	2000	2020
F-19	Streams												
	Coldwater	283	359	515	705	29	29	29	29	254	330	486	676
	Warmwater	1,651	2,097	3,004	4,111	1,162	1,162	1,162	1,162	489	935	1,842	2,949
	Lakes												
	Warmwater	2,784	3,534	5,064	6,931	947	947	947	947	1,837	2,587	4,117	5,984
	Total Freshwater	4,718	5,990	8,583	11,747	2,138	2,138	2,138	2,138	2,580	3,852	6,445	9,609
	Anadromous	355	451	646	884	35	243	341	460	320	208	307	424
	Saltwater	2,379	3,037	4,353	5,956	2,379	2,447	2,528	2,609	0	590	1,825	3,347
F-20	Streams												
	Coldwater	6	8	10	13	3	3	3	3	3	5	7	10
	Warmwater	257	308	402	514	170	170	170	170	87	138	232	344
	Lakes												
	Warmwater	379	455	594	759	379	557	629	629	0	0	0	130
	Total Freshwater	642	771	1,006	1,286	552	730	802	802	90	143	239	484
	Anadromous	160	193	252	322	160	202	227	262	0	0	25	60
	Saltwater	226	269	351	448	226	294	375	456	0	0	0	0
F-21	Streams												
	Coldwater	107	132	167	209	21	21	21	21	86	111	146	188
	Warmwater	626	771	974	1,220	626	642	642	642	0	129	332	578
	Lakes												
	Warmwater	1,055	1,299	1,643	2,056	1,017	1,017	1,017	1,017	38	282	626	1,039
	Total Freshwater	1,788	2,202	2,784	3,485	1,664	1,680	1,680	1,680	124	522	1,104	1,805
	Anadromous	446	552	697	871	139	346	444	531	307	206	253	340
	Saltwater	1,832	2,276	2,875	3,599	1,832	1,900	1,981	2,062	0	376	894	1,537
Sub-Region F	Streams												
	Coldwater	396	499	692	927	53	53	53	53	343	446	639	874
	Warmwater	2,534	3,176	4,380	5,845	1,958	1,974	1,974	1,974	576	1,202	2,406	3,871
	Lakes												
	Warmwater	4,218	5,288	7,301	9,746	2,343	2,521	2,593	2,593	1,875	2,767	4,708	7,153
	Total Freshwater	7,148	8,963	12,373	16,518	4,354	4,548	4,620	4,620	2,794	4,415	7,753	11,898
	Anadromous	961	1,196	1,595	2,077	334	791	1,012	1,253	627	405	583	824
	Saltwater	4,437	5,582	7,579	10,003	4,437	4,641	4,884	5,127	0	941	2,695	4,876

TABLE 0-13 (CONT.)

North Atlantic Region

Fish Habitat Class	Demand Thousands of Man-Days				Capability Thousands of Man-Days				Needs Thousands of Man-Days			
	1965	1980	2000	2020	1965	1980	2000	2020	1965	1980	2000	2020
Streams												
Coldwater	11,077	13,136	16,397	20,330	10,734	11,072	11,506	11,857	343	2,064	4,891	8,473
Warmwater	7,921	9,434	12,104	15,337	5,954	6,237	6,603	6,897	1,967	3,197	5,501	8,440
Lakes												
Coldwater	11,344	13,146	16,091	19,651	11,344	12,578	14,206	15,387	0	568	1,885	4,264
Warmwater	26,399	31,211	39,215	48,882	23,182	24,915	27,018	28,659	3,217	6,296	12,197	20,223
Total Fresh-water	56,741	66,927	83,807	104,200	51,214	54,802	59,333	62,800	5,527	12,125	24,474	41,400
Anadromous	2,120	4,923	6,164	7,654	1,483	1,592	1,683	1,773	637	3,331	4,481	5,881
Saltwater	36,567	42,435	52,959	65,361	36,567	37,315	38,206	39,097	0	5,120	14,753	26,264
Total Sport-fishing	95,428	114,285	142,930	177,215	89,264	93,709	99,222	103,670	6,164	20,576	43,708	73,545

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TABLE O-14

RECREATIONAL SHELLFISHING DEMAND - 1965-2020

(Figures in thousands)

Sub-Region	1965 Fishermen	1965 Man-days	1980 Fishermen	1980 Man-days	2000 Fishermen	2000 Man-days	2020 Fishermen	2020 Man-days
A	30	150	35	170	40	200	47	240
B	276	1380	330	1,660	414	2,070	513	2,560
C	125	620	140	720	167	840	200	1,000
D	150	750	180	880	220	1,100	273	1,360
E&F	125	620	150	760	198	990	255	1,280
Total N.A.R.	706	3,520	835	4,190	1,039	5,200	1,288	6,440

related to finfish resources throughout the North Atlantic Region, together with comparable figures for demand and for resource capability for meeting demand. Figures are for the base year 1965 and for the benchmark years 1980, 2000, and 2020. Most of the needs shown are not the result of a lack of resources per se; the principle factor is lack of access permitting public use. This is true in the case of both fresh-water and salt-water categories.

Shellfish

In addition to sport fishing for finfish, considerable recreational use is made of the estuarine shellfisheries. In order to measure the impact of recreational demand upon shellfish resources, an estimate of the number of individuals participating was first developed. This estimate was based upon information abstracted from the publication titled A Plan for the Marine Resources of the Atlantic Coastal Zone.[1/] These estimates of demand are shown in Table 0-14. They were projected in direct proportion to population estimates.

A comparison between supply and demand was necessary in order to estimate recreational shellfishery needs. Demand was predicated on the following assumptions: one bushel of shellfish per day as the satisfaction level and five shellfishing days per person per year as the participation rate. The actual pounds of meat per bushel varies between species and within the same species, depending upon the geographic location from which they are taken. For example, hard clams range from eight to twelve pounds per bushel, soft clams from twelve to sixteen, and oysters from four to nearly eight. In general, pounds of meat per bushel for these species tend to decrease in waters south of New York but are relatively stable from that State northward.

The recreational shellfishery supply was estimated by first assuming that most of such activity occured in waters less than six feet (one fathom) deep. The amount of habitat shoreward of the one fathom line was determined and from this total, areas of polluted waters were subtracted to obtain the net amount of habitat available to recreational shellfishermen.

The average annual sustained harvest capability was estimated at 75 bushels per acre of habitat. Each acre of productive shellfish habitat, therefore, has a capability of supporting 75 man-days or 15 recreational shellfishermen. The recreational shellfish habitat and capability are shown in Table 0-15.

The capability of the resource for supporting recreational shellfishing is compared to the demand in Table 0-16. The results

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1/ Spinner, G.P., American Geographical Society, 1969.

TABLE O-15

RECREATIONAL SHELLFISHING AREAS AND CAPABILITY

(Figures in thousands)

Sub-Region	Total Recreational Shellfish Habitat (bushels)	Polluted Recreational Habitat (acres)	Productive Recreational Shellfish Habitat (acres)	Recreational Shellfishermen Capability (bushels)	Capability Shellfishing-days (Rounded)
A	350	71	279	4,180	20,900
B	64	12	52	780	3,900
C	104	13	91	1,360	6,800
D	68	25	43	640	3,200
E&F	550	87	463	6,940	34,700
Total N.A.R.	1,136	208	928	13,900	69,500 1/

1/ According to our analysis this represents a total of 69.5 million bushels of shellfish (at 1 bushel per person per man-day) which is approximately equivalent to 469,025,000 pounds of shellfish (meat) at the average rate of 6.75 pounds per bushel.

TABLE 0-16

CAPABILITY OF RESOURCES COMPARED WITH DEMAND FOR RECREATIONAL SHELLFISHING OPPORTUNITIES - 1965-2020

(Figures in thousands)

	Capability		Demand[1/]							
			1965		1980		2000		2020	
Sub-Region	No. of Fishermen	No. of Man-Days	No. of Fishermen	No. of Man-Days	No. of Fishermen	No. of Man-Days	No. of Fishermen	No. of Man-Days	No. of Fishermen	No. of Man-Days
A	4,185	20,925	30	150	34	170	40	200	47	240
B	780	3,900	276	1,380	331	1,660	414	2,070	513	2,560
C	1,365	6,825	125	620	143	720	167	840	200	1,000
D	645	3,225	150	750	176	880	220	1,100	273	1,360
E & F	6,945	34,725	125	620	151	760	198	990	255	1,280
Total N.A.R.	13,920	69,500	706	3,520	835	4,190	1,039	5,200	1,288	6,440

1/ At average rate of 5 days per fisherman per year.

show there are no needs for additional recreational shellfish habitat during the time frame of this study, provided the area and quality of productive habitat available for recreational harvest remains at the present level. Needs in the commercial category of shellfish use do exist, however, and to a considerable extent will be competitive with recreational use. If the total recreational and commercial demand upon resources within the one fathom limit exceeds the supply, both types of need will likely be unsatisfied. Recreational demand in terms of bushels of shellfish and pounds of meat harvested is shown in Table 0-17.

Commercial

Commercial fishing demand in general was calculated by expanding current harvest rates within each Sub-region in proportion to national population projections. The demand in the vicinity of Chesapeake Bay, however, was derived from information in the publication titled Fish and Wildlife Resources as Related to Water Pollution[1/]. A summary of estimated demand, together with estimated supply is contained in Table 0-18.

A summary of commercial needs for estuarine-dependent species is presented by Sub-regions in Table 0-19.

NON-CONSUMPTIVE ACTIVITIES

Demand

Man shares with all organisms a dependency upon the environment in which he lives. A proper concern of that environment requires that particular attention be given to the aesthetic, educational, and recreational amenities derived from fish and wildlife resources. The quality of the environment does not start at the edge of the wilderness however; it starts at home, in our cities, and along the roads. Urbanization which results in the isolation of human population from areas where fish and wildlife are abundant makes it more difficult for man to appreciate the soil-plant-animal relationship upon which his existence depends.

Supply

Even though the importance of fish and wildlife values in relation to the spectrum of the environment is recognized, the fact remains that these values are extremely difficult to assess. This is because they are based upon intangible "goods", and the interpretations of the values of these are as varied as the individuals who

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1/ Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, U.S. Department of the Interior, October, 1968.

TABLE O-17
DEMAND FOR RECREATIONAL SHELLFISHING OPPORTUNITIES - 1965-2020
(Bushels of shellfish/Pounds of meat harvested/Figures in thousands)

	1965		1980		2000		2020	
Sub-Region	Bushels	Pounds	Bushels	Pounds	Bushels	Pounds	Bushels	Pounds
A	150	1,012	170	1,148	200	1,350	240	1,620
B	1,380	9,315	1,660	11,205	2,070	13,973	2,560	17,280
C	620	4,185	720	4,860	840	5,670	1,000	6,750
D	750	5,062	880	5,940	1,100	7,425	1,360	9,180
E&F	620	4,185	760	5,130	990	6,682	1,280	8,640
Total NAR	3,520	23,760	4,190	28,283	5,200	35,100	6,440	43,470

TABLE O-18. CAPABILITY OF ESTUARINE-DEPENDENT COMMERCIAL FISHERIES (1965) AND DEMAND (1965-2020)
(Figures in thousands)

Sub-Region	Type of Resource	Capability 1/	Demand			
			1965	1980	2000	2020
A	Edible Finfish	380	253	326	473	633
	Industrial Finfish	4,659	3,106	4,007	5,808	7,765
	Shellfish	6,098	3,909	5,043	7,310	9,773
	Seaworms	2,264	1,509	1,947	2,822	3,773
B	Edible Finfish	21,117	14,078	18,161	26,326	35,195
	Industrial Finfish	10,971	7,314	9,435	13,677	18,285
	Shellfish	11,482	5,847	7,543	10,934	14,618
	Seaworms	114	76	98	142	190
C	Edible Finfish	18,404	12,269	15,827	22,943	30,673
	Industrial Finfish	45,246	30,164	38,912	56,407	75,410
	Shellfish	15,068	7,534	9,719	14,089	18,835
D	Edible Finfish	26,070	17,380	22,420	32,500	43,450
	Industrial Finfish	181,340	120,893	155,952	226,070	302,233
	Shellfish	9,396	4,698	6,060	8,785	11,745
E & F	Edible Finfish	103,230	44,829	74,240	124,476	224,482
	Industrial Finfish	240,000	398,238	399,376	545,940	759,047
	Shellfish	105,000	118,131	133,877	222,764	436,960
Total	Edible Finfish	169,201	88,809	130,974	206,718	334,433
N.A.R.	Industrial Finfish	432,216	559,715	608,182	847,902	1,162,740
	Shellfish	147,044	140,119	162,242	263,382	491,931
	Seaworms	2,378	1,585	2,045	2,964	3,963

1/ Capability is a measure of the sustained yield that a given supply of fishery resources could support under present environmental conditions.

TABLE 0-19
COMMERCIAL NEEDS FOR ESTIMATING ESTUARINE-DEPENDENT SPECIES - 1965-2020
(Thousands of pounds)

	Benchmark Years	1965	1980	2000	2020
Sub-Region	Type of Resource				
A	Edible Finfish			93	253
	Industrial Finfish			1,149	3,106
	Shellfish			1,212	3,675
	Seaworms			558	1,509
B	Edible Finfish			5,209	14,078
	Industrial Finfish			2,706	7,314
	Shellfish				3,136
	Seaworms			28	76
C	Edible Finfish			4,539	12,269
	Industrial Finfish			11,161	30,164
	Shellfish				3,767
D	Edible Finfish			6,430	17,380
	Industrial Finfish			44,730	120,893
	Shellfish				2,349
E&F	Edible Finfish			21,246	121,252
	Industrial Finfish	158,238	159,876	305,940	519,047
	Shellfish	13,131	28,877	117,764	331,960

TABLE O-20

NAR SUMMARY OF CAPABILITY, DEMANDS AND COMMERCIAL NEEDS FOR ESTUARINE-DEPENDENT SPECIES - 1965-2020

(Thousands of pounds)

TYPE OF RESOURCE	CAPABILITY 1/	DEMAND				NEEDS			
		1965	1980	2000	2020	1965	1980	2000	2020
Edible Finfish	169,201	88,809	130,974	206,718	334,433			37,517	165,232
Industrial Finfish	482,216	559,715	608,182	847,902	1,162,740	77,499	125,966	365,686	680,524
Shellfish	147,044	140,119	162,242	263,882	491,931		15,198	116,838	344,887
Seaworms	2,378	1,585	2,045	2,964	3,963			586	1,585

1/ Capability is a measure of the sustained yield that a given supply of fishery resources could support under present environmental conditions.

hold them important. The preservation, maintenance, and development of habitat as well as management for those species associated with fishing and hunting as recommended in this Appendix, will go a long way toward providing adequate consideration for the less well-documented activities also related to fish and wildlife resources. The matter of correcting urban deficiencies, however, has been largely neglected. Subsequent planning of more intensive scope should give attention to this aspect.

An attempt has been made to quantify some of these intangible values derived from at least a minimum of related activities other than fishing and hunting. The wildlife oriented activities listed in the 1965 Survey of Outdoor Recreation Activities[1/] were used as a basis for developing present and projected nonconsumptive participation. These activities were birdwatching, wildlife photography, and nature walks. (See Table 0-21).

Needs

In addition to the general basin participation, estimates were also determined for the use in Standard Metropolitan Statistical areas of 1,000,000 population or more. Because of the problem of access and lack of facilities, it was assumed that the use in existing areas was presently at maximum. The additional projected demands, therefore, represent needs for additional facilities. These projected needs related to nonconsumptive uses originating from Standard Metropolitan Statistical Areas are presented in Table 0-22.

ECONOMIC IMPACT OF DEMAND

Recreational

Hunting and Fishing

The development of demand for outdoor recreational opportunities in recent years has been phenomenal. All studies have shown that, insofar as possible, there should be maximum development of fish and wildlife resources in each basin if supply is to be kept abreast of or brought equal to demand. Meeting needs for outdoor recreational activities in the future is today a major objective in planning for use of land and water resources.

Planning for use of water and related land resources in the North Atlantic Region has as its overall purpose (as do other such planning efforts) the improvement of the general welfare of the people in that Region. It seeks to create, ultimately, more business opportunities, more jobs, higher levels of personal incomes,

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1/ Bureau of Outdoor Recreation, U.S. Department of the Interior, October, 1967.

TABLE 0-21
NON-CONSUMPTIVE USE - 1965-2020 1/
(Figures in thousands)

Basin	1965 Population Estimates	Basin-Wide Non-Consumptive Use in Man-days 2/				SMSA Non-Consumptive Use in Man-days 3/			
		1965	1980	2000	2020	1965	1980	2000	2020
A-1	109	137	143	167	196				
A-2	163	205	207	243	284				
A-3	137	172	219	257	299				
A-4	160	201	238	275	323				
A-5	134	206	224	262	308				
Sub-Region A	733	921	1,031	1,204	1,410				
B-6	432	606	689	847	1,049				
B-7	990	1,245	1,465	1,831	2,266				
B-8	1,712	2,154	2,921	3,696	4,624				
B-9	4,719	2,529	2,966	3,734	4,585	3,407	3,975	4,848	5,914
B-10	2,170	2,730	3,114	3,995	5,054				
Sub-Region B	10,073	9,264	11,155	14,103	17,578	3,407	3,975	4,848	5,914
C-11	553	702	782	898	1,051				
C-12	1,888	2,375	2,555	3,097	3,733				
C-13	11,213	(Entire basin an SMSA location)				14,107	16,204	19,647	23,594
Sub-Region C	13,659	3,077	3,337	3,995	4,784	14,107	16,204	19,647	23,594

1/ Based on participation rates for bird watching, wildlife photography, and nature walks.
2/ To obtain total basin non-consumptive use add both SMSA and basin-wide figures.
3/ SMSA locations were selected areas of 1 million or more population.

TABLE O-21 (CONT.)
NON-CONSUMPTIVE USE - 1965-2020 1/
(Figures in thousands)

Basin	1965 Population Estimates	Basin-Wide Non-Consumptive Use in Man-days 2/				SMSA Non-Consumptive Use in Man-days 3/			
		1965	1980	2000	2020	1965	1980	2020	2020
D-14	3,565	572	649	840	1,010	3,913	4,342	5,209	6,251
D-15	6,954	3,022	3,723	4,769	5,938	5,726	6,829	8,537	10,671
D-16	1,309	1,647	1,877	2,346	2,900				
Sub-Region D	11,828	5,241	6,249	7,955	9,848	9,639	11,171	13,746	16,922
E-17	3,442	4,330	5,112	6,384	7,931				
E-18	2,242	358	512	634	780	2,462	2,672	3,313	4,077
Sub-Region E	5,684	4,688	5,625	7,018	8,711	2,462	2,672	3,313	4,077
F-19	3,522	1,402	1,918	2,760	3,769	3,028	3,728	5.330	7,303
F-20	373	469	561	731	935				
F-21	1,748	2,200	2,723	3,441	4,306				
Sub-Region F	5,643	4,071	5,202	6,932	9,010	3,028	3,728	5.330	7,303
Total N.A.R.	47,620	27,262	32,599	41,207	51,341	32,643	37,750	46,884	57,810

1/ Based on participation rates for bird watching, wildlife photography, and nature walks.
2/ To obtain total basin non-consumptive use add both SMSA and basin-wide figures.
3/ SMSA locations were selected areas of 1 million or more population.

TABLE O-22

PROJECTED NON-CONSUMPTIVE NEEDS IN MAN-DAYS ORIGINATING FROM SMSAs OF 1 MILLION OR MORE POPULATION

(Figures in thousands/Increases are incremental)

(SMSA Origin)

Basin in which need will occur	1980						2000						2020					
	Boston (9)	NY-NJ (13-14)	Phil. (15)	Balt. (18)	Wash.DC (19)	Total	Boston (9)	NY-NJ (13-14)	Phil. (15)	Balt. (18)	Wash.DC (19)	Total	Boston (9)	NY-NJ (13-14)	Phil. (15)	Balt. (18)	Wash.DC (19)	Total
B-6	10	-	-	-	-	10	16	-	-	-	-	16	19	-	-	-	-	19
B-7	112	-	-	-	-	112	188	-	-	-	-	188	229	-	-	-	-	229
B-8	46	-	-	-	-	46	72	-	-	-	-	72	87	-	-	-	-	87
B-9	360	-	-	-	-	360	552	-	-	-	-	552	675	-	-	-	-	675
B-10	7	-	-	-	-	7	10	-	-	-	-	10	13	-	-	-	-	13
C-12	-	313	-	-	-	313	-	534	-	-	-	534	-	618	1,691	-	-	618
C-13	-	1,092	-	-	-	1,092	-	1,863	-	-	-	1,863	-	2,155	229	-	-	2,155
D-14	-	813	-	-	-	813	_	1,388	-	-	-	1,388	-	1,606	102	-	-	1,606
D-15	-	60	875	2	-	937	-	103	1,354	8	-	1,465	-	120	26	9	-	1,820
D-16	-	147	118	-	-	265	-	250	183	-	-	433	-	290	-	-	-	519
E-17	-	-	53	14	-	67	-	-	82	43	-	125	-	-	-	18	-	120
E-18	-	-	13	159	140	312	-	-	20	483	318	821	-	-	-	577	393	996
F-19	-	-	-	24	499	523	-	-	-	73	1,142	1,215	-	-	-	87	1,406	1,493
F-20	-	-	-	3	25	28	-	-	-	8	58	66	-	-	-	43	71	114
F-21	-	-	-	-	8	8	-	-	-	-	19	19	-	-	-	-	24	24
Total	535	2,425	1,059	202	672	4,893	838	4,138	1,639	615	1,537	8,767	1,023	4,789	2,048	734	1,894	10,488

etc., as well as to improve the amenity aspects. The following discussion will consider the magnitude of the impact which could be brought to bear upon the economy of the Region if fish and wildlife resources are conserved and developed to meet projected needs.

The desire (or demand) of a large percentage of the American people for recreation related to fish and wildlife resources calls for a considerable outlay for goods and services. This has a considerable impact upon the economy of (1) the localities whence these people come, (2) the areas to which they travel for recreation, and (3) the areas through which they travel from one to another of these places. The amount of the total impact which may occur in any one of these three general areas will be governed to a large degree by factors of distance, duration of trip, facilities provided, amount and success of advertising activity, etc. It is no secret that the recreation business, in all its aspects, is highly competitive. Even with outstandingly attractive natural resources, there must be sufficient money, effort, and time expended in advertising, developing accomodations, and building up goodwill to bring maximum numbers of hunters and fishermen, recreational shellfishermen, and those who seek other forms of wildlife-related recreation into the resource areas and hold them there as long as their individual amounts of leisure time will allow.

To the extent that hunters, fishermen, and other outdoor recreationists are drawn to a given area by the fish and wildlife resources and can be induced to obtain the goods and services they require and to spend the major portion of their leisure time in that area -- to that extent will the area's economic welfare be enhanced. This is a particularly important means of distributing urban wealth to rural areas.

Figures given in the subsequent paragraphs were developed from hunter and fisherman demand estimates and from data provided by the 1965 National Survey of Fishing and Hunting. An itemized breakdown of expenditures of hunters and fishermen in 1965 is given in Table O-23.

Modifications have been made in these itemized expenditures in order to estimate the additional economic influence exerted by others whose recreation is fish and wildlife oriented. Thus it was possible to arrive at estimates of the impact of recreational shellfishermen and those who enjoy nature walks, bird-watching, and the photographing of birds and wild animals.

Table O-24 shows economic impact estimates for sportfishing and hunting for the base year 1965 and subsequent bench mark years. These values are estimated expenditures of fishermen and hunters only and therefore represent only a portion of the total economic impact related to fish and wildlife resources; there are generally others who accompany the sportsman to the resource area

TABLE O-23

1965 EXPENDITURES FOR FISH AND WILDLIFE UTILIZATION AND ENJOYMENT

Average Annual Expenditures per Hunter[1/]

Expenditure item	$ Expended per big-game hunter	$ Expended per small-game hunter	$ Expended per water fowl hunter
Food and lodging:			
Food	$ 6.34	$ 5.99	$ 6.63
Lodging	2.14	.42	1.77
Transportation:			
Automobile	10.62	7.15	6.88
Bus, rail, air, and water	.22	.66	1.98
Auxiliary equipment:			
Boats and boat motors	.79	1.85	2.74
General	8.78	3.20	2.91
Hunting equipment	20.25	21.97	19.38
Licenses, tags, and permits	5.84	2.57	3.93
Privilege fees and other:			
Annual lease and privilege fees	1.47	.39	.82
Daily entrance and privilege fees I *	.62	.40	.62
Daily entrance and privilege fees II**	.55	.27	1.87
Guide fees and other trip expenses	2.35	.52	1.37
Dogs	2.82	11.85	1.57
Other	.98	.95	.35
TOTAL	$63.78	$58.17	$52.81

* Daily fees for hunting on commercially operated preserves
** Daily fees for hunting on wild lands

Average Annual Expenditures per Fisherman[1/]

Expenditure item	$ Expended per fresh-water fisherman	$ Expended per saltwater fisherman
Food and lodging:		
Food	$ 10.70	$ 9.64
Lodging	3.31	2.14
Transportation:		
Automobile	13.64	8.74
Bus, rail, air, and water	.71	2.08
Auxiliary equipment		
Boats and boat motors	16.23	15.16
General	5.77	2.38
Fishing equipment	10.45	7.78
Licenses, tags, and permits	2.66	.18
Privilege fees and other:		
Annual lease and privilege fees	.22	.02
Daily entrance and privilege fees	1.84	1.13
Bait, guide fees, and other trip expenses	21.60	28.64
Boat launching fees	.34	.43
Other	1.24	.95
TOTAL	$ 88.71	$ 79.27

Average Annual Expenditures per Recreational Shellfisherman[1/]

Expenditure item[2/]	$ Expended
Transportation:	
Automobile	$ 8.74
Auxiliary equipment:	
General	2.38
Licenses and permits	.18
TOTAL	$ 11.30

Average Annual Expenditures per Non Consumptive User[3/]

Expenditure item[2/]	$ Expended
Food and lodging:	
Food	$ 13.88
Lodging	3.81
Transportation:	
Automobile	16.92
Bus, rail, air, and water	1.25
TOTAL	$ 35.86

1/ Persons 12 years old or older; nationwide average
2/ Judgment determination
3/ Non Consumptive users (12 years or older) include nature walkers, bird watchers, and wildlife and bird photographers

TABLE O-24

ECONOMIC IMPACT OF EXPENDITURES FOR SPORT FISHING AND HUNTING - 1965-2020

(Figures in thousands)

	Big-game No.	Big-game $ Expend.	Small-game No.	Small-game $ Expend.	Waterfowl No.	Waterfowl $ Expend.	All Hunters No.	All Hunters $ Expend.	Fresh-Water & Anadromous No.	Fresh-Water & Anadromous $ Expend.	Saltwater No.	Saltwater $ Expend.	All Fishermen No.	All Fishermen $ Expend.
Sub-Region A														
1965	127	8,128	114	6,612	10	530	251	15,270	249	22,088	35	2,774	284	24,862
1980	140	8,960	120	6,960	11	583	271	16,503	307	27,234	38	3,012	345	30,246
2000	163	10,432	140	8,120	13	689	316	19,241	356	31,581	44	3,488	400	35,069
2020	192	12,288	162	9,396	15	795	369	22,479	419	37,169	51	4,043	470	41,212
Sub-Region B														
1965	191	12,224	371	21,518	42	2,226	604	35,968	900	79,839	625	49,544	1,525	129,383
1980	233	14,912	412	23,896	50	2,650	695	41,458	1,157	102,637	724	57,391	1,881	160,028
2000	291	18,624	506	29,348	62	3,286	859	51,258	1,446	128,275	901	71,422	2,347	199,697
2020	363	23,232	622	36,076	78	4,134	1,063	63,442	1,734	153,823	1,175	93,142	2,909	246,965
Sub-Region C														
1965	128	8,192	314	18,212	50	2,650	492	29,054	439	38,944	1,000	79,270	1,439	118,214
1980	140	8,960	332	19,256	57	3,021	529	31,237	491	43,557	1,146	90,843	1,637	134,400
2000	163	10,432	385	22,330	68	3,604	616	36,366	581	51,541	1,390	110,185	1,971	161,726
2020	193	12,352	451	26,158	82	4,346	726	42,856	691	61,299	1,669	132,302	2,360	193,601
Sub-Region D														
1965	368	23,552	574	33,292	48	2,544	990	59,388	587	52,073	575	45,580	1,162	97,653
1980	388	24,832	676	39,208	56	2,968	1,120	67,008	700	62,097	659	52,239	1,359	114,336
2000	486	31,104	834	48,372	69	3,657	1,389	83,133	873	77,444	824	65,318	1,697	142,762
2020	603	38,592	1,026	59,508	87	4,611	1,716	102,711	1,081	95,896	1,019	80,776	2,100	176,672
Sub-Region E														
1965	375	24,000	651	37,758	46	2,438	1,072	64,196	609	54,024	164	13,000	773	67,024
1980	442	28,288	726	42,108	52	2,756	1,220	73,152	735	65,202	185	14,665	920	79,867
2000	552	35,328	879	50,982	65	3,445	1,496	89,755	916	81,258	229	18,153	1,145	99,411
2020	684	43,776	1,088	63,104	80	4,240	1,852	111,120	1,135	100,686	282	22,354	1,417	123,040
Sub-Region F														
1965	265	16,960	512	29,696	27	1,431	804	48,087	393	34,863	308	24,415	701	59,278
1980	334	21,376	542	31,436	33	1,749	909	54,561	511	45,331	369	29,251	880	74,582
2000	458	29,312	741	42,978	46	2,438	1,245	74,728	676	59,968	528	41,855	1,204	101,823
2020	609	38,976	977	56,666	61	3,233	1,647	98,875	900	79,839	697	55,251	1,597	135,090
NAR TOTAL														
1965	1,454	93,056	2,537	147,088	223	11,819	4,214	251,963	3,177	281,832	2,707	214,584	5,884	496,416
1980	1,677	107,328	2,808	162,864	259	13,727	4,744	283,919	3,901	346,058	3,121	247,402	7,022	593,460
2000	2,113	135,232	3,485	202,130	323	17,119	5,921	354,481	4,848	430,066	3,916	310,421	8,764	740,487
2020	2,644	169,216	4,326	250,908	403	21,359	7,373	441,483	5,960	528,712	4,893	387,868	10,853	916,580

but do not themselves hunt or fish.

Estimated expenditures for fishermen and hunters in the NAR will amount to $593.5 million and $283.9 million, respectively, in the year 1980; by the year 2000 these figures will reach $740.5 million and $354.5 million; and in the year 2020, comparable figures will have reached a level of $916.6 million and $441.5 million. These amounts, we must emphasize, are only potentials, but they are potentials which will become realities if there is adequate conservation and development of fish and wildlife resources. The figures are in terms of dollar values and prices as of 1965.

In order to estimate the magnitude of the economic impact brought to the Region's economy by fish and wildlife resources, additional expenditures must be added to the aforementioned recreational sportfishermen and hunter gross expenditures.

The present and projected economic impact estimates for recreational shellfishermen are given in Table 0-25. These expenditures are expected to reach $.8 million by 1980, grow to $1.0 million by the year 2000, and ultimately reach $1.3 million in the year 2020.

Non-Consumptive Activities

In addition to the economic impact exerted by the consumptive users is that which is exerted by the non-consumptive users. The previously mentioned activities which are wildlife dependent and capable of being qualified at this time are listed in Table 0-26. This Table lists the participation rates of these three activities in man-days and their corresponding gross dollar expenditures. These people exert a considerable influence on the economy as the Table shows. The economic impact predicted for 1980 is $274.4 million, $343.6 million for 2000, and $425.7 million in 2020. Again, these figures are based on 1965 price levels and dollar value. These values, although considerable, are probably a minimum estimate. This is because only three activities are represented. These man-day values, which for this study have been directly expanded with the population, are in fact undoubtedly expanding at a much greater rate because of increasing leisure time and more income available for expenditure on items other than the necessities of life.

Commercial

Commercial fishing is another consumptive use of the fishery resources that exerts an important impact on the economy. Assuming that net average price levels at equivalent dollar values remained constant, the net values of the catch to satisfy the shellfish demand of 1980 would be $47.1 million; of 2000, $74.9 million; and of 2020, $132.4 million. The estimated net values for finfish would be $21.3 million for 1980, $30.5 million for 2000, and $42.8 million for the year 2020. For seaworms, the estimated values are

TABLE O-25

ECONOMIC IMPACT OF EXPENDITURES BY RECREATIONAL SHELLFISHERMEN

(Figures in thousands)

	1965		1980		2000		2020	
Sub-Region	No.	$ Expend.	No.	$ Expend.	No.	$ Expend.	No.	$ Expend.
A	30	339	34	384	40	452	47	531
B	276	3,119	331	3,740	414	4,678	513	5,797
C	125	1,413	143	1,616	167	1,887	200	2,260
D	150	1,695	176	1,989	220	2,486	273	3,085
E&F	125	1,413	151	1,706	198	2,237	255	2,882
Total N.A.R.	706	7,978	835	9,436	1,039	11,741	1,288	14,554

TABLE O-26
ECONOMIC IMPACT OF EXPENDITURES BY NON-CONSUMPTIVE USERS 1/
(Figures in thousands)

Sub-Region	1965		1980		2000		2020	
	No. Man-Days	$ Expend.	No. Man-Days	$ Expend.	No. Man-Days	$Expend.	No. Man-Days	$Expend.
A	921	3,592	1,031	4,021	1,204	4,696	1,410	5,499
B	12,671	49,417	15,130	59,007	18,951	73,909	23,492	91,619
C	17,184	67,018	19,541	76,210	23,642	92,204	23,378	110,674
D	14,880	58,032	17,420	67,938	21,701	84,634	26,770	104,403
E	7,150	27,885	8,297	32,358	10,331	40,291	12,788	49,873
F	7,099	27,686	8,930	34,827	12,262	47,822	16,313	63,621
Total N.A.R.	59,905	233,629	70,349	274,361	88,091	343,555	109,151	425,689

1/ Based on participation rates for bird watching, wildlife photography, and nature walks.

$1.7 million in 1980, $2.4 million in 2000, and $3.3 million in 2020. These values are listed in Table 0-27. From this Table the net value of the commercial fishery as measured by anticipated landings will be $70.1 million in 1980, $107.8 million in 2000, and $178.4 million in the year 2020. The gross impact on the economy, of course, is much greater than the value at the landings.

Summary

Summing up all the above values exclusive of the commercial fishery, indications are that there was a market for goods and services which was in the magnitude of $.9 billion in 1965 and which can reasonably be expected to reach a level of $1.2 billion in 1980, $1.5 billion by the year 2000, and $1.9 billion by the year 2020. The extent to which the impact of this potential market will affect the welfare of the NAR rests largely with its people and the effort they are willing to put forth to get it. It will take vision and determination as well as hard work. Assistance from the State and Federal Governments will also be necessary. Without sufficient competitive effort to maintain the attractiveness of fish- and wildlife-oriented recreation and a high level of desire to participate in it, much of the anticipated future demand could remain latent or disappear completely.

In essence, the same may be said for the commercial fishery values which are projected to amount to $70 million by 1980, $107.8 million by 2000, and $178.4 million by 2020 (in terms of 1965 dollar values).

TABLE 0-27

ECONOMIC IMPACT OF COMMERCIAL USE OF ESTUARINE DEPENDENT FISHERIES - 1965-2020

(Figures in thousands)

		1965		1980		2000		2020	
Sub-Region	Type of Resource	Pounds	$Value	Pounds	$Value	Pounds	$Value	Pounds	$Value
A	Finfish	3,359	103	4,333	133	6,281	193	8,398	258
	Shellfish	3,909	1,057	5,043	1,364	7,310	1,977	9,773	2,643
	Seaworms	1,509	1,207	1,947	1,557	2,822	2,257	3,773	3,018
B	Finfish	21,392	1,667	27,596	2,150	40,003	3,117	53,480	4,168
	Shellfish	5,847	3,081	7,543	3,974	10,934	5,761	14,618	7,703
	Seaworms	76	93	98	120	142	174	190	233
C	Finfish	42,433	2,074	54,739	2,675	79,350	3,878	106,083	5,185
	Shellfish	7,534	6,303	9,719	8,131	14,089	11,787	18,835	15,758
D	Finfish	138,273	4,291	178,372	5,535	258,570	8,024	345,683	10,728
	Shellfish	4,698	2,008	6,060	2,590	8,785	3,755	11,745	5,020
E & F	Finfish	443,067	10,120	474,116	10,829	670,416	15,313	983,529	22,465
	Shellfish	118,131	27,370	133,877	31,018	222,764	51,613	436,960	101,240
TOTAL	Finfish	648,524	18,255	739,156	21,322	1,054,620	30,525	1,497,173	42,804
NAR	Shellfish	140,119	39,819	162,242	47,077	263,882	74,893	491,931	132,364
	Seaworms	1,585	1,300	2,045	1,677	2,964	2,431	3,963	3,251

CHAPTER 3. PROBLEMS AND POSSIBLE SOLUTIONS

INTRODUCTION

The road to greater abundance of fish and wildlife resources to meet future demands for recreation and assure maximum economic benefit to the NAR is beset with many problems. These problems will be compounded by an increase in human population which almost inevitably tends to erode the resource base through alteration and/or destruction of fish and wildlife habitat. While changes in land-use and water-use patterns affecting fish and wildlife are inevitable, the direction and degree of change can be greatly influenced by concerted efforts of planning agencies at the Federal, State and local levels. Determined efforts at local and State levels are especially important to realize to the fullest extent the benefits which can be obtained through carefully conserving and developing their fish and wildlife resources.

RECREATIONAL FISHERIES

Fresh-water

Orientation

Providing freshwater fishing opportunities and adequate numbers of fish to satisfy the increased future demand on fishery resources will require both conservation and development. There has been a loss of the original stream-type habitat (largely from pollution) and some increase in lake-type habitat due to construction of reservoirs and small impoundments. Indications are that the past trend of loss of habitat and decreasing productivity has been checked. The past loss of habitat and decreased productivity widened the gap between the supply of fishery resources and the demand on them. Conservation of the remainder of the habitat and restoration of those portions which have been damaged are essential to meet future demand.

A number of major problems must be solved in order to satisfy, insofar as possible, present and future needs for fishing opportunity. These problems are created by lack of public access for fishermen, pollution, fluctuations in stream flows, irrigation, impassable barriers to fish movement, insufficient fishery habitat, and conflicts with other uses, including other recreational uses.

Access for Fishermen

Fisherman access as defined in this report is a guarantee that a public right-of-way exists to enable fishermen to reach the water and travel along the banks or shores. Inadequate public access is probably the most pressing factor limiting optimum use of

available sport fishing opportunities in the North Atlantic Region. Increasing population pressures will undoubtedly mean that access to water areas will become more limited. With the demand for desirable land for industrial and residential development increasing, (especially that fronting on stream and lakes), further depletion of water access will occur.

Considered as specific facilities, fishermen access sites can vary throughout the whole range from primitive to complex -- primitive connotating less intensive development (low design load) and complex meaning more intensive (high design load). Generally speaking, the farther a fisherman access facility is from an urban area, the less intensive its development needs to be.

Fishermen access in rural areas may consist of a public right-of-way to the banks of a fishable body of water. This could consist of such a simple facility as an unimproved road to the water's edge, with a front footage strip along the shore to permit fishing from the bank, or wading, or launching small boats. The other extreme is the highly complex, intensively developed facility required in areas of heavy use. This could consist of a paved parking lot, boat launching ramps, sanitary facilities, fishing piers, and concession services. Between these extremes various integrades of fisherman access facilities could exist depending on the intensity of use anticipated.

The following are examples of fisherman access requirements in heavily used areas:

Streams: A road to the vicinity of water's edge and a right-of-way along the bank for a prescribed distance with provision for sanitary facilities if necessary.

Rivers and Lakes: In addition to the above, a boat launching ramp and a parking area together with necessary sanitary facilities.

Availability of fishing access is especially critical near urban areas. Suitable fishery habitat in the form of private lakes and water supply reservoirs is frequently present in many of these areas where the needs are greatest. Opening these waters to fishing and providing access to them would help to meet some of the demand for fishing opportunity.

Each of the states within the NAR has an active program for acquisition and development to make fishing waters available for public use. Lake and stream frontage, however, is rapidly becoming such expensive real estate that future acquisition for this purpose may be greatly curtailed. It becomes urgent, therefore, that acquisition programs be accelerated if public access for fishing is to be assured for the future.

Water Quality

Restoration of water quality satisfactory for production of fishes and related food-chain organisms in polluted streams would create additional fishing opportunity. Pollution of fishing streams is a primary limiting factor in the North Atlantic Region. Pollution falls into eight broad categories: (1) drainage from coal mines (2) organic wastes (effluent from industrial, municipal, or agricultural activities), (3) potential nutrient material, (4) sedimentation, (5) radioactive substance, (6) heat from power and industrial plants, (7) toxic industrial effluents (8) toxic agricultural chemicals.

It is necessary to consider the causes and nature of the foregoing pollution in order to offset adverse fishery effects. Water pollution has been the major detriment from coal mining operations. This is a problem primarily in the Delaware, Susquehanna, and Potomac River Basins. Coal seams and adjacent strata generally contain pyrite (iron sulfide). Pyrite in the presence of air and water reacts to produce sulphuric acid and iron sulfate. The iron sulfate when dissolved in water hydrolizes to form more sulphuric acid.

Acids change the water quality of streams into which they are discharged, affecting aquatic life in several ways. The acids may be present in such concentrations as to be directly lethal, and they may bring about changes in the condition of existence and rate of growth and reproduction of aquatic species.

In addition to undesirable acid in effluents from coal mining, iron hydroxide is precipitated when these waters enter streams. Iron hydroxide or "yellow boy" coats the stream bottom which destroys benthic habitat.

Reclamation of strip-mined lands is essential, in order to alleviate the problem of acid-mine drainage. Reclamation procedures that reduce water flow into mines, minimize contact time of water with acid forming substances, and buffer acidity by liming of streams or addition of naturally alkaline waters will be beneficial.

Organic material may cause depletion of oxygen as decomposition takes place. Organic material may also create abnormally high levels of plant nutrients as decay progresses. (The introduction of nutrients, however, is also direct, as in runoff from fertilized fields (commercial fertilizers) and effluent from sewage treatment plants). Excessive growth of vegetation, either rooted or planktonic, limits light penetration and thereby limits the productive capabilities of the habitat. Excessive growth of aquatic plants can also cause oxygen depletion in certain rivers and lakes by yet another process. In this case oxygen depletion may occur during cloudy days or at night when photosynthesis is inhibited or stopped. During such periods plants consume oxygen from the water which they cannot

replenish. The resultant oxygen sag is at times sufficient to eliminate fish species and most types of aquatic organisms. Excessive nutrients may also favor certain noxious water-weeds such as Eurasian water-milfoil and the water chestnut, enabling these species to displace more valuable plants.

The sources of nutrients may be municipal sewage or wastes from food processing plants (canneries, dairies, and meat packing establishments). Some kinds of industrial wastes also contribute, such as those from drug and chemical factories, refineries, and research laboratories. Even the widespread use of chemical fertilizers in urban areas as well as on farms contributes to the fertilization of our surface waters.

The control of this over-enrichment of surface waters is a complex matter which has received little attention until recently. Ordinary water purification systems, the accepted methods of treating organic wastes, do not usually control the nutrient levels of the treated water. In other words, the mere construction of new sewage treatment plants does not mean that stream quality will automatically become suited to the desired species of fish and other aquatic life. Low cost methods of controlling levels of available nitrogen and phosphorus must be developed soon, particularly if we are to preserve the capacity of the aquatic environment to produce the products we desire. Biologists can describe fairly well the concentrations of dissolved oxygen and various organic or inorganic chemicals which are required or can be tolerated by various organisms. Parameters for the most desirable levels of plant nutrients, however, will need to be worked out specifically for particular locations, since there is such great variety of interacting factors in various waters. While this is a problem of biology, there is also the related problem, the mechanics of control, which lies with sanitary engineers and administrators and managers in industry and agriculture.

Sedimentation is another factor limiting aquatic productivity. Sedimentation is caused by many factors including erosion, construction, and mining. As sediment accumulates, reservoirs are filled, rivers and streams are clogged, and fish spawning and fish food-organism habitat is destroyed. Conservation of soil disturbed by such projects as road building, laying of pipe lines, and other construction works along streams should be accomplished. Minimizing erosion through proper land use and flood control on small watersheds would reduce sediment loads and materially improve and extend productive habitats.

With the advent of nuclear power plants and their anticipated increase in the future, the likelihood of radioactive pollution increases. It is known that certain aquatic plants and animals concentrate radioactive substances. These radioactive substances are transferred from one organism to another through various levels of the food chain. Transfers may result in further concentration of these substances, since nuclides tend to accumulate in fatty tissue.

Migratory fish, mammals and birds may distribute these substances over a wide geographical area. Continued biological monitoring must be performed in order to detect possible radioactive buildup in such organisms. If radioactive accumulation is determined, then methods to reduce radioactive discharges could be employed.

Large volumes of heated water discharged into the aquatic habitat from electric power and industrial plants can cause profound effects on the aquatic environment. Such discharges may not only be detrimental to fish life directly but may also affect these resources indirectly through subtle changes affecting the ecology of other aquatic organisms. Higher temperatures diminish the solubility of dissolved oxygen and thus decrease the availability of this essential gas. The elevated temperatures increase the metabolism, respiration, and oxygen demand of fish and other aquatic life; hence, the demand for oxygen is increased under conditions where the supply is lowered.

Any thermal barriers that occur would interfere seriously with the value of the habitat for fish and related organisms and restrict movement of fishes either upstream or downstream.

The thermal requirements of an aquatic organism are quite variable, complex and difficult to ascertain since they are influenced by season, age, size, and other factors. By "thermal requirements" is meant the temperature limits which will permit survival at at level which allows for continuity of the species.

Another effect of increased water temperatures could be the promotion of unattractive, oxygen-consuming blooms of algae. Extensive blooms of green and blue-green algae are not only unsightly but can cause fish kills through oxygen depletion.

Many possible solutions are available to minimize and prevent the above mentioned adverse effects of heated discharges to the aquatic environment. Careful site selection and design of the discharge facilities are of paramount importance. Additional cooling may be obtained by use of cooling ponds or towers. Where necessary, closed circuit cooling systems can be installed.

Toxic industrial effluents are detrimental to acquatic life. These toxic effluents include acids, alkalies, petrochemicals, heavy metals, detergents, and surfactants.

Many agricultural chemicals are also toxic to aquatic life. These chemicals may be grouped under the broad heading of pesticides. Pesticides include insecticides, herbicides, fungicides, defoliants, and algicides.

The Water Quality Act of 1965 (Public Law 89-234), coupled with the growing public demand for and administrative emphasis on clean waters, has given impetus to the development of abatement programs which are expected to reduce the detrimental effects of

pollution on fisheries in the NAR before long. Pollution abatement would be a significant contribution to gaining a greater amount of fishing opportunity from existing streams.

Low Flows and Floods

Extreme variation from periods of very high to periods of very low flow is the characteristic hydrologic pattern common to many streams in the NAR. Too much water during spring run-off period and the summer "cloud-burst" season causes bank erosion, bottom scouring, and a physical alteration of the pool-to-riffle ratio that is not conducive to maximum fish production and survival. The spring period of high discharge may reduce the quality of fishing opportunity coincidental with the period of peak fishing demand on the streams. Conversely, by late summer the flow in many streams has dropped to only a fraction of the early summer flows and fishing opportunity may again be curtailed. Low flows concentrate fish in small pools, subjecting them to increased predation and increased competition for food, oxygen, and space. Such flows of decreased velocity and increased temperature may result in unfavorable cold-water fishery habitat. Facilities constructed for flood control and storage for other purposes, including low-flow augmentation, could alleviate these streamflow problems where biologically and economically justified. If flow augmentation is of sufficient magnitude, it could benefit the anadromous and estuarine, as well as freshwater fisheries.

Another effect of flood-flow reduction will be the facilitation of projects designed to improve fish habitat through bank stabilization, fencing, erosion control, and development of better pool-to-riffle ratios. Where justified, these improvements could be carried out by the respective state fish and game agencies.

Low-flow augmentation could greatly benefit stream fishing recreation in some areas. Satisfactory stream-fishing conditions could be extended through and beyond the critical late summer period, resulting in improved survival of fish populations. Coupled with stream improvement work, low-flow augmentation, where applicable, could greatly enhance stream-fishing opportunities.

Low-flow augmentation, provided sufficient cold-water could be supplied from storage, could greatly enhance the fishery habitat of streams now of marginal quality. There are many such streams in the NAR -- streams which cannot support year round populations because of seasonal warming of waters or periods when flows become too low to provide satisfactory habitat. Diversion of waters for irrigation or other uses may aggravate the situation in a given stream. Conservation of spring runoff could, in many instances, serve to alleviate late spring and summer conditions which are adverse to fisheries and other water needs.

In streams of the above character, low-flow augmentation

offers benefits to coldwater stream fisheries by extending fishing over a longer period of time and by stabilizing stream flows. There may be benefits in reducing stocking required and improved quality of the fishery. Stocked trout not caught by the angler in one season could survive until the next spring; natural reproduction could take place to supplement the stocking program; and more abundant populations of food organisms could develop to improve stream carrying capacity for fish.

Generally, multiple level outlets would be the preferred release mechanism for low-flow augmentation because they would allow selective withdrawal of water having proper quality and temperature. This would allow more favorable temperatures to be maintained in the stream, preserving the colder water at lower levels to supplement the downstream flow during critical high-temperature, low-flow periods. It will also prevent the possibility of oxygenless water being used for downstream flow augmentation.

Low-flow augmentation can also be a solution for improving water quality. In certain streams low flows are inadequate in diluting pollution loads which results in pollution blocks having insufficient dissolved oxygen levels to support aquatic life. This is especially critical to migratory fish. In these instances, where an adverse condition persists after all efforts possible have been made to control the pollution at its source, low-flow augmentation may prove of value in improving the fishery habitat.

Minimum Stream Flow Requirements

In addition to low-flow conditions caused by natural phenomena, there are those caused by man-made alterations of the environment. These alterations are mainly physical structures in the form of dams which curtail natural stream flow. Hydroelectric power projects whose generating capacities serve primarily to meet peak power demands generally create rapid and severe fluctuations of flow daily. These fluctuations can be very destructive to downstream fishery resources. In addition to such alteration of the natural stream flow, there is the actual removal of water by consumptive water users. Diversion of stream flow is presently a problem in certain basins and will become an even larger one in the future. This is because of future plans for increased interbasin transfers of water as well as increased consumptive use. These problems of altered flows could be resolved through state establishment of legal minimum flow requirements.

Destruction of Habitat

Destruction of productive fishery habitat both in quantity and quality has been a major problem within the North Atlantic Region. Dredging and filling of marshlands have eliminated prime spawning and nursery areas. Flood control reservoirs and channelization have eliminated many miles of stream fisheries. Erection of

impassable dams has blocked migratory fish runs. These are numerous other man-made alterations have been performed upon the fishery habitat. The adverse effects of many of these facilities or activities could be eliminated through effective coordination and planning between constructing agencies (both governmental and non-governmental), state fish and game departments, and the Fish and Wildlife Service. Such cooperative planning could result in selection of an alternative method of accomplishing the desired objective which would have a less adverse effect on the habitat.

Irrigation

Irrigation is a growing threat to fishery resources of the NAR. Pumping water for irrigation from the streams during critically low periods reduces fishing opportunity and lessens chances for fish survival. The problem could be resolved through storage of water for low-flow augmentation for both fishery and irrigation use.

Lack of Habitat

The problems and possible solutions discussed in the preceding paragraphs had to do with existing water areas in streams and lakes. While these in themselves are very important considerations, there must be additional fishery habitat created if future needs are to be met. It is quite obvious that this additional habitat will have to be in the form of lakes.

It is realized that construction of additional lake-type habitat will result in loss of stream fisheries. For this reason selection of sites that will result in a minimum of such damage should be sought. Streams with little fishery potential should be chosen where possible, because little loss would result and enhancement of stream fisheries by regulation of flow could occur.

In order to insure maximum fishery development the following actions should be implemented: (1) provide adequate public access consisting of at least one boat launching ramp and associated parking area for each 300 surface acres of water (at least one, also, if the impoundment is less than 300 acres in size); (2) coordinate reservoir clearing plans with the appropriate state fish and game agency and this Bureau; (3) adopt reservoir zoning operations which will prevent loss of fishing opportunity due to competition with other water-oriented activities; (4) and operate reservoir so as not to unduly interfere with maintenance of a productive fishery and its maximum use.

Competition with Other Water Uses

There are many competing uses for water and related land resources -- for water to meet industrial and municipal water supply needs, for water surface areas to meet recreational and commercial

boating and shipping needs, for flowing water to turn and cool electric power plants, etc. It is the purpose of planning, of course, to eliminate conflicts insofar as possible or find acceptable compromises between them. The actual working out of these problems as related to specific future actions are concerned must await more detailed planning than is appropriate to a framework effort such as the North Atlantic Regional Study. Even where such problems now exist, there are on-going programs endeavoring to bring about improvements. Conflicts are being resolved at a more or less acceptable rate -- except in the case of water supply reservoirs in the northeast. Acceptability as used here, of course, has reference to fish and wildlife conservation interests, both as regards the rate and the manner of resolution.

The single-purpose use of water supply reservoirs in many of the basins in the North Atlantic Region has prevented recreational use of these waters and perimeter lands. As pointed out in this study, there is a definite need for increased recreational areas near urban centers and this need will grow with increased urbanization and industrialization. The proximity and accessibility of many water supply reservoirs to large population centers can help satisfy this need if they are opened to public use. It has been repeatedly demonstrated that recreational use can be made of domestic water supply reservoirs without detriment to potability or human health. Permitting controlled sport fishing and other compatible recreational uses of water supply reservoirs is a practical solution. Future water supply reservoirs should be constructed with adequate treatment facilities so as to insure recreational use of the impoundment and its watershed. In addition, adequate treatment facilities should be incorporated into existing water supply systems to permit controlled sport fishing use of the reservoirs which serve them. The public can be best served through multiple-use management of these reservoirs.

Anadromous

General Discussion

In order to meet both recreational and commercial needs related to anadromous fishery resources, it may be possible to reestablish "runs" in some of the rivers which once hosted an abundance of these fishes. Certain aspects of anadromous fisheries will be discussed later with respect to commerce.

Many of the problems and possible solutions listed under fresh-water fisheries are equally applicable to the anadromous category. These problems include polluted habitat, dammed waterways, low-flow periods, habitat destruction, inaccessible resources, and unrestricted competition for what resources are available.

Since many of the possible solutions to the above problems have already been discussed in the fresh-water section just

preceding, they need not be treated again at this point, except as they relate particularly to anadromous species.

Problems

Water Quality. Polluted conditions in many rivers and their tributaries within the NAR render them unsuited to support anadromous fish migrations. Pollution has depreciated or eliminated much spawning and nursery habitat and has created "pollution" (in the Delaware and Penobscot Rivers, for example) which delay or prevent upstream migration of adults and the subsequent return to the sea of both adults and juveniles.

Destruction of Habitat. Dam construction has also served to reduce or eliminate anadromous fish runs. Dams are today a major obstacle to restoration of these runs. More dams are planned; some are under construction. For the most part, dams have in the past presented insurmountable barriers, denying the fish access to upstream spawning grounds vital to perpetuating the several species. Many dams, too many dams, in the North Atlantic Region still do so.

Access for Fishermen. Lack of access facilities has deprived the fishing public of opportunity to enjoy angling for anadromous fishes in rivers which still do support significant runs; this is a problem which must be faced also on streams for which restoration of runs is planned or underway. It is further complicated by the fact that one does not catch these fishes just anywhere throughout the course of a stream; American shad, for example, are caught primarily at points where there is a restriction of some sort in the channel so that a concentration of fish occurs. Atlantic salmon fishing spots are limited by the number and the quality of pools.

Competition for Resources. Anadromous fish supplies are in demand not only for recreational fishing but also, in the case of most species, commercial fishing as well. During the periods spent at sea, these fishes are exploited by the fishing fleets of many nations. Returning to their home streams to spawn, many are taken by sport as well as commercial fishermen. The possibility of use exceeding the capability of the resource to supply the demand on a sustained yield basis is ever present.

Possible Solutions

For the re-establishment of anadromous fishes, needs are so great that all possibilities for improvement should be implemented and since they are generally dependent, one upon the other, for success, implementation on an individual or piecemeal basis will prove of little or no value.

Possible solutions include alleviation of pollution,

construction of fish-passage facilities at both existing dams and those yet to be built, removal or breaching of obsolete dams or other barriers, provisions for maintaining adequate flow at all times to assure satisfactory habitat conditions, acquisition and development of fisherman-access facilities, improvement of habitat in nursery and spawning ground areas particularly, construction of additional hatching and rearing facilities, particularly for Atlantic salmon, and an expanded program of research and management on the international as well as at national and state levels. Additional legislation, even international treaties or conventions, may be necessary to the establishment of proper control and management.

The re-establishment of anadromous fish runs in every basin within the North Atlantic Region where historically one or more species was present in significant numbers is probably not realistic. Highest priority and greatest investment should be given to those rivers having the greatest potential for re-establishment of one or another of the important species. Meeting demands in all basins will depend upon the degree of capability which can be developed in those having the greatest potential.

Salt-water

Problems in General

Salt-water sport-fishery supplies when considered as a separate entity and a regional resource provide the greatest potential for future fishing opportunities. To realize this potential, however, the present habitat together with its related fishery supply must be preserved and maintained. Moreover, additional public fishermen-access facilities must be provided to insure optimum use of the resource.

In order to preserve existing habitat and fishery resources, problems that may reduce its potential must be solved. These problems include pollution, dredging and filling, marsh destruction, and transbasin diversions.

Access for Fishermen

The problem of lack of public access has been discussed in previous sections on fresh-water and anadromous fisheries. The lack of access is especially critical for salt-water sportsmen. This is because many interests are seeking salt-water frontage. Desirable land is scarce and therefore commands a high price.

Salt-water fishing access can consist of a paved access-road and parking lot with either additional ocean frontage (if use is for surf-fishing) or fishing piers. Boat launching facilities would be desirable in protected waters. Provision for sanitary facilities should be made at these access sites.

Because of the pressing need for public fishermen-access, provisions for public access rights should be incorporated into every project where public monies are being spent and where government permits are being issued giving license to alter the environment either physically or chemically. Examples of these would be road construction, where a road overpasses a fishable body of water. Here a parking area and a fishing walkway which parallels the road would be extremely beneficial. Dike and jetty construction for flood and hurricane protection also offer opportunities for incorporating fishing access as a multiple-purpose use.

Fishing access is and will continue to be especially critical near the coastal metropolitan areas. Development of saltwater fisherman-access facilities in these areas would be highly desirable. Provisions for fishing piers, jetties, walkways, etc. in such locations will greatly increase fishing opportunities where the need is greatest.

Habitat Improvement

Provisions should also be made for habitat improvement, such as the construction of artificial fishing reefs, in order to attract and concentrate sport fish to the vicinity of these access facilities.

COMMERCIAL FISHERIES

Problems

The estuarine-dependent commercial fisheries have many of the same problems that have reduced the value of the sports fisheries. These include physical reduction of important nursery and spawning habitat, pollution, change of environment due to altered flows from tributaries that feed the estuaries, blockage of anadromous runs by impassable physical or chemical barriers, and in certain cases, over-exploitation of the resource.

In addition to the above are the jurisdictional problems associated with management of the resources and the environment. The traditionally accepted right of every state and every individual to fish in the sea has led to over-exploitation or excessive fishing pressure in many fisheries. This in turn has tended to reduce profits and deplete stocks of fish. As long as there are no restrictions on entry, fishing effort increases to the point, and sometimes beyond, where costs for and income from the fishing effort are equal and profit ceases. For many important fisheries, this point usually occurs, or at least is not recognized, until the biological capability of the resource to produce is exceeded.

These undesirable results stem not from ignorance but from rational efforts by individual fishermen to maximize profits. An

individual fisherman cannot successfully restrict his own fishing effort in the interest of future returns because what he leaves in the water for tomorrow will be taken by other fishermen today. Thus, in the absence of control over fishing, depletion of the resource is almost a certainty. Garrett Hardin calls it the "Tragedy of the Commons".

This tendency toward over exploitation of common-property fisheries has been recognized for many years. Regulations (for sport fishermen and commercial fishermen alike) have long been designed to conserve the resource and protect it from overfishing. These regulations, however, have not altered the "free entry" or "open access" doctrine which is a root problem. They have tended to allow for "too many" fishing units to remain in the fishery, but worse, they have in effect attempted to prevent overfishing by downgrading efficiency, thus increasing costs and resulting in a worsening economic and biological situation.

The responsibility and authority for commercial fisheries management and regulations are divided among federal, state, and local authorities, but with certain exceptions, jurisdiction over the estuarine-dependent fisheries is primarily in the hands of the states. This present political arrangement does not permit carrying out a national fishery and environmental policy in the best interest of the Nation. States alone find it difficult to act because (1) most resources and their environment are shared by more than one State, or the resources move freely out of any single State's jurisdiction, (2) they lack adequate scientific information upon which to base regulations, (3) they regulate usually without regard to the economic implications and (4) they have difficulty in rationally allocating among competing uses for the fishery resources and the environment.

Possible Solutions

In order to meet the anticipated needs for commercial fisheries, many of the following measures should be implemented. Preservation and maintenance of the estuaries, their associated wetlands, and the coastal waters are the major objectives.

Because of the interrelation of rivers, estuaries, and coastal waters, changes in quality and quantity of water in rivers will influence conditions in the two last named. Maintenance of desirable conditions in one portion of a drainage area however, should not be permitted at the expense of degradation of other portions.

Attaining a high level of water quality in a given river will directly benefit its estuary. This, coupled with a program of water quality improvement within the estuary itself will have immediate and direct effects. Anadromous fish will benefit from

improved conditions for spawning and juvenile growth. Many shellfish areas now closed because of health hazards will be opened to harvesting. Fish which are dependent on estuarine areas for part or all of their life cycle will find former habitat, now marginal for growth, to be favorable once again.

Since many of the commercial species used for food or industrial products, (namely, striped bass, smelt, salmon, alewives, and shad) are anadromous, solutions recommended under anadromous fishery resources will apply and help supply the needs.

Although the commercial fish were separated into the categories edible and industrial fish, it should be mentioned that conceivably in the future these distinctions could prove misleading. With the advent of Fish Protein Concentrate (FPC), today's industrial fish could become tomorrow's food fish.

Also, a major portion of the industrial-fish harvest is converted to fish meal which is utilized as an animal feed. It is particularly important as a main constituent of the feed that is utilized by the large, poultry-producing industry. Indirectly, then the "industrial" fish is being converted to human food and therefore could be considered an "edible" fish. A decreased food supply in the future, changing technology, and dietary habits could then combine the categories of edible and industrial fish into one commercial fish supply. If needs for edible fish at some future cannot be met in any other way, then conversion of industrial fish to an acceptable meat or protein substitute may present a feasible alternative.

It should be mentioned that although the freshwater commercial harvest is insignificant in the NAR, new technology in the field of fish meal and FPC production could make harvest of that resource economically feasible. Larger rivers, lakes, and reservoirs could thus support a commercial fishery utilizing species presently considered undesirable for sport fishing. This could be a solution to help meet future needs for food or other fish products.

The commercial fishing industry will be influenced by many factors. In the long run, the increase in population; rise in per capita income; shift to higher protein diets; continued government intervention in the market to help industry improve its competitive position; new uses of fishery products; modern technology; proximity of major fishing grounds; rising wage rates in competing countries; a recognition of the common property aspect of fisheries and changing social and political arrangements to overcome problems related to it; greater world demand for fishery products and thus a lessening in available foreign supplies -- these all favor an increase in domestic fisheries production and employment. In the immediate future, however, a sense of a lack of social status; limited earnings; likelihood of continued competition from foreign fleets; competition from the low-cost, mass-produced protein foods; fluctuations in fish

supply -- these and other factors favor a decrease. Continued effort will be needed, therefore, to strengthen those factors benefiting industry the most.

The fishing industry will need assistance from State and local governments to incorporate the newest and most efficient technological methods of finding and catching fish and for handling, preserving, and transporting the catch. By these means it might be possible to double the annual harvest. Larger and more highly mechanized craft will permit not only larger catches but improved working conditions and pay and social status as well. Through research and development, many new and economic uses will be found for fishery products and fuller utilization will be made of existing resources.

The initial steps needed to carry this forward have been taken. What is required now is continuation and expansion, with a firm base in economic knowledge concerning the advantages of required changes and the future of the product in the marketplace. Water quality improvement can be an important first step in bringing about these improvements.

WILDLIFE

General Discussion

The problems inherent in the development and utilization of wildlife resources are primarily a function of supply and demand. In order to meet the demands of the people, it is necessary to maintain (or develop) and make available a supply of sufficient magnitude so that the demand can be satisfied. When the supply or the opportunity to use this supply is less than the demand, then a need exists. Where there is a need, there are one or more wildlife problems which must be resolved if the need is to be met.

These problems in the NAR occur primarily as a result of restricted access and/or physical alteration of the habitat. Briefly, they develop as a result of items such as: highway construction, urban and industrial development, dredging and filling, drainage, pollution, detrimental or inefficient timber utilization, prohibitions against access established by private landowners, certain agricultural land-use practices, flooding of wildlife habitat by impoundments, and inadequate legislative regulations.

Solutions to the problems associated with wildlife resources are to be found in those means and measures which can be employed for the betterment of wildlife species and the development of opportunities providing for maximum sustained yield and use of these resources. There are numerous devices that can be considered in the conservation and development of the resources. These devices include the following:

Access for Hunting and Other Uses

The satisfaction of hunting demands (and, in fact, the availability of all wildlife-use opportunities) is dependent upon some form of access. Although the means of providing access can take many forms, the basic problem is still one and the same.

The lack of public access is, and probably will continue to be, the major limiting factor affecting hunting opportunity in the NAR. Land is predominately in private ownership and thus subject to being closed to public hunting whenever the owner decides to do so. Farmers who have had buildings, fences, stock, or crops damaged by hunters or other trespassers invariably post their lands. Many holdings once operated as farms have been and are being bought by individuals or groups to use for other purposes and these lands are then commonly posted. Additional lands are being posted because of landowners liability to those who utilize their properties. No-trespass and no-hunting signs, in short, are rapidly becoming a common sight and no reversal of this trend, in the near future at least, is anticipated.

Should the extensive areas of private land holdings now open to hunting be closed, then large areas would be lost to both non-consumptive recreational uses and hunting. For certain species, cessation of hunting could result in an over-utilization of their food supplies, which in time could largely destroy both the habitat and species. In some instances over population could create nuisance conditions, as well.

The first consideration, obviously, for minimizing access problems should be the retention of currently existing recreational use opportunities on private lands but, in addition, it will be necessary in certain areas to provide still more access in order to satisfy projected demands.

Urban and industrial expansion, together with agricultural intensification, effectively destroys wildlife habitat and curtails hunting opportunities. These activities in themselves are marks of progress toward betterment of certain vital aspects of life in the NAR. The problem is, of course, how to integrate and maintain fish and wildlife resources to achieve maximum environmental quality.

The impact of population increases in the NAR can be visualized better perhaps when it is considered that construction of a single house, lawns and driveways included, eliminates about 1/4 acre of what may have been huntable wildlife territory. Added to this is a safety zone extending 500 feet in all directions from each occupied dwelling or cluster of dwellings. "Strip development" along roads, moreover, is effectively and increasingly preventing hunter access to interior lands otherwise huntable.

The effect of urban "sprawl" and hit or miss rural developments could be offset to some extent by local zoning regulations. Town planners or their consultants could seek the advice of their state fish and game agency in determining lands which should be set aside to be maintained as public hunting areas.

The identification of specific types of access as well as the cost of providing each type will vary depending on the location. In areas where access is a factor limiting adequate recreational opportunities, the type of access best suited to meet the need will generally include one or more of the following:

1. Reduction in number of posted areas.

2. Acquisition of Easements.

3. Land acquisition in fee title by public agencies.

4. Cooperative landowner programs.

Methods which should be considered for providing specific types of access include: land leasing, tax subsidies, reducing the liability of the landowner, outright acquisition, and revision of certain legislative regulations related to Federal and State land use.

Habitat Conservation and Development

Generally, the increased habitat requirements of man have worked to decrease the available wildlife habitat. Man has profoundly altered both the quantity and quality of wildlife habitat. The activities of man are readily apparent in all sections of the NAR.

Areas which once contained rabbits and quail are now suburban housing developments. Rivers and marshy areas that previously harbored wildlife species such as ducks, frogs, and blackbirds are now streamlined with concrete culverts. Wooded areas that used to contain deer and other wildlife have been developed for industrial use. Other habitat and associated wildlife species are being lost through highway construction, drainage, agricultural land use practices, and urban expansion. At the same time, however, man has maintained an innate desire to hunt and observe the wildlife resources that are dependent on the habitat he is so effectively destroying. The fact that man intends to use the available wildlife resources for his recreational pleasure is clearly evidenced from estimates that show these resources presently supporting 38.2 million man-days of hunting in the NAR. Furthermore, this demand is expected to increase to 66.3 million man-days by the year 2020.

The human demands for use of wildlife resources cannot be satisfied unless adequate wildlife populations are available. To maintain these wildlife populations involves the conservation and development of their habitat. The conservation and development of

existing habitat then, is the most important element for plans which seek to meet future needs related to wildlife resources.

It is recognized, however, that in some locations habitat losses are inevitable. When this occurs an alternative method for maintaining adequate habitat could be the initiation of habitat management programs. These programs could be designed to increase both the quality of the remaining habitat for any given species and possibly provide increased habitat carrying capacity for other species.

Habitat management techniques will vary depending on the location and species involved. Measures to assist in maintaining or increasing wildlife supplies, however, will include, but not necessarily be limited to, the following:

1. Improvement of areas producing undesirable trees and shrubs through chaining, cutting or bulldozing. These practices encourage sprouting and release of previously inhibited ground vegetation. The techniques also create needed openings and provide food and cover.

2. Harvesting timber crops in designated areas following a cutting plan that allows block cutting and strip cutting. These techniques will stimulate new growth in ground vegetation and ultimately provide additional food supplies.

3. Burning areas, under strict controls to achieve the same results mentioned in 1 and 2.

4. Planting of desirable plant species for food supplies and cover.

5. Development of several different "habitat types" within the species home range.

6. Improvement of wetland areas through:

   (a) Controlled burning.
   (b) Cratering.
   (c) Planting desirable plant species for food and cover.
   (d) Maintaining border areas for plant cover around marshes, sloughs, potholes, ponds, and other water areas; and,
   (e) Development of methods for regulating water levels to promote maximum growth of desired food plants.

Waterfowl Habitat

The extensive marsh areas, mud flats, and tidal shallows located in the NAR make this region an extremely important asset from the standpoint of waterfowl migration and wintering ground areas. As such, the NAR is an integral part of the extensive avian flight path referred to as the "Atlantic Flyway". Actually, a flyway is a vast region that has extensive breeding grounds and wintering areas connected by a complicated system of migration routes. The migration routes vary between waterfowl species and may shift from year to year because of environmental changes. Such environmentally induced shifts can be caused by weather, increased or decreased food supplies, nesting cover, and water areas. The breeding grounds which supply the Atlantic Flyway overlap those supplying the Mississippi, Central, or Pacific Flyways, especially in the breeding grounds of the northern United States, Canada and Alaska. It is obvious that the role of the NAR in the national waterfowl picture cannot be defined in terms of purely local circumstances and considerations for waterfowl.

Agricultural, industrial, and municipal development has caused a constant and rapid reduction of waterfowl habitat over the years. If these reductions continue, the waterfowl habitat in the North Atlantic Region will soon be in short supply, and it follows, so will opportunities for waterfowl hunting and nonconsumptive uses.

In order to alter this past trend the preservation, restoration, and development of waterfowl habitat are needed to conserve our waterfowl resources. Waterfowl are the farthest ranging of our game birds and, therefore, require great acreages of marsh and open water associated with food producing areas. The preservation of the existing habitat, coupled with development of restoration of additional habitat areas, thus becomes a need of the highest priority in managing waterfowl. These areas should include but not necessarily be limited to those lands which can do the following:

1. Serve as important migration and wintering habitat.

2. Provide adequate opportunities for public recreation and hunting.

3. Contribute needed additions to existing areas for more effectively meeting waterfowl management needs.

4. Produce more waterfowl.

5. Lend themselves to effectively being restored to a former status as waterfowl habitat.

These principles must be recognized and acted upon if waterfowl populations are to survive in sufficient numbers to assure their availability for recreational use in future years.

Administration and Legislation

The role that both administration and legislative actions can play in the perpetuation of wildlife resources should not be overlooked. There are several management techniques that can be utilized where appropriate action is warranted. Game populations can be re-introduced into areas or relocated to accommodate additional recreational opportunities. In addition, the introduction of game not native to the area (exotics) represents possible avenues for new wildlife supplies.

Additional techniques that would in all probability overlap with legislative action include (1) the effective utilization of wildlife resources through manipulation of season lengths, bag limits, week-end hunting, and controlled area hunting, which can be achieved through continuing surveillance of resource and habitat fluctuations; (2) research programs designed to provide practical application of methods for measuring resource populations and related habitats; and (3) provisions for wilderness areas for species that cannot or will not adapt to human encroachment.

RARE AND ENDANGERED SPECIES

Habitat Preservation

Habitat deterioration or reduction is of major significance to the perpetuation of rare and endangered species. When the loss of habitat exceeds the tolerance limits of the species, these resources become threatened with extinction.

Permitting man's indiscriminate use of wildlife habitat may result in the irreplaceable loss of plants, animals, and wildlife communities. Where unavoidable losses to the habitat occur, continual emphasis must be placed on both habitat and species management to assure the preservation of our vanishing species.

As mentioned in the previous section of the report, those fish and wildlife species in the NAR presently considered as rare and endangered represent 10 percent of all species in these categories in the United States. There is no adequate method for determining in advance what species may have to be included on the rare and endangered lists in future years. Indications are, however, that the past trend of general indifference to the preservation of wildlife species is being reversed.

Legislative Protection

The Endangered Species Conservation Act of 1966 (Public Law 89-669) has given impetus to the development of protection for rare and endangered species. This Act is primarily concerned with those species of fish or wildlife which are in imminent danger of extinction. It also focuses attention on the need to correct gross mismanagement of wildlife resources before a given species reaches the actual point of endangerment. In addition, the Act authorizes the Secretary of Interior to initiate and carry out a program for the protection, conservation and propagation of endangered species of native fish and wildlife. To assist in carrying out the purpose of the Act, the Secretaries of Agriculture and Defense are required to take measures to protect threatened species of fish and wildlife and, where practicable, preserve the habitat of such species on lands under their jurisdiction.

The Endangered Species Conservation Act of 1969 (Public Law 91-135) further provides for the preservation of native species threatened with extinction by prohibiting importation of any endangered species--worldwide. It also directs the Secretary of the Interior through the Secretary of State to cooperate with other countries in providing technical assistance in efforts to protect other species from becoming threatened with extinction.

These Acts represent examples of the action needed to preserve wildlife species for posterity. These programs, or any future proposals, must produce positive action to avert additions to the present list of rare and endangered species and to prevent new additions to the list of extinct species.

CHAPTER 4. FISH AND WILDLIFE PLAN

GENERAL DISCUSSION

Planning Concepts

A major difference setting the North Atlantic Regional Resources Study apart from many previous river basin planning studies is the multiple objective approach. This approach utilizes three sets of objectives -- National Income, Regional Development and Environmental Quality. In effect, this procedure requires that three separate region-wide plans be developed in preparation for formulation, presumably, of a single plan which will embody the most desirable (or the most desired) features of all three.

Planning for Environmental Quality focuses attention upon preserving and enhancing those natural or man-created resources which are necessary if man-kind is to have a satisfactory environment in all its aspects. For National Income, the key to planning is to fulfill those demands which are supportable if organized on a free market basis. A Regional Development plan would seek to achieve satisfaction of demands which, when fulfilled and combined with repayment and tax policies, promise the greatest net income, employment, or production gains for the region, regardless of the effect upon other regions.

Concepts in Relation to Needs

Needs related to fish and wildlife resources have been assumed to remain the same, regardless of the planning objective.[1/] Plans developed under each of the three objectives will vary both as to the cost of and competence in meeting those needs.

If the objective were National Income, it would be most economical to select and implement certain measures among the available alternatives, e.g., preservation of existing high-quality habitat, provision of fishing and hunting access to existing habitat, opening-up of existing single-purpose lakes and reservoirs for multiple-purpose use, etc.

With maximum Regional Development as the planning objective, needs could be satisfied by subsidizing certain enterprises or constructing more costly devices. Such devices include reservoirs, water quality control facilities, fish hatcheries, and intensified fish and wildlife management, to name only a few. By going to greater

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1/ The assumption obviously is not valid; available data, however, did not permit further refinement.

lengths to provide the means of satisfying demand within the basins and the region in which it originates, fishermen, hunters, and non-consumptive users of fish and wildlife resources will be encouraged to remain within their basin and/or region, thus contributing by their expenditures to its economy. Improvements within the region may also be justified (from a regional viewpoint) as a means of making it more attractive and thus more competitive with other regions, further increasing the magnitude of business related to fish and wildlife resources within its own area. For example, in rivers such as the Penobscot, the Connecticut, or the Delaware, specialized, high-value anadromous fisheries can be developed, thereby favoring economic (as well as recreational) development of the North Atlantic Region.

Construction of dams, fishways, water treatment plants, etc., provide benefits through employment of regional labor and markets for products of regional industry. Levels of income and employment along the coast could also be improved through increased commercial fishing, provided it is possible to put our domestic fishing industry on a competitive level with that of foreign countries.

If the major planning objective is to preserve and improve Environmental Quality, it would be important that the plan incorporate devices to enhance present satisfaction levels (as well as the abundance of opportunities) for outdoor recreational experiences related to fish and wildlife resources. This, of course, would give additional encouragement for residents of areas in which such improvements took place to satisfy their recreational needs in this respect close to home and would improve the attraction of such areas for non-residents. It would, moreover, encourage those who had not done so before to participate in these forms of recreation.

But it is possible that devices might well be justified on the basis of improved recreational quality alone, even though no increase in the total amount of use occurred. Benefits in monetary terms would be reflected by the additional amount per day that the user would be willing to pay for the improved recreational opportunity. For example, it is conceivable that a low value sport fishery could be changed to a high value warmwater or coldwater fishery through devices to control water-quality factors. Or it might be possible to provide higher quality recreation by employing several relatively small impoundments rather than a single large one, thus gaining diversification of fishing opportunities and less concentration of the fishermen. Conversely, under certain conditions a single large reservoir might provide for more desirable environmental quality.

Placing primary stress on achieving maximum environmental quality might also mean that the plan would go further in providing for access to fish and wildlife resources and opportunities for recreational use of them. That is, more access could be warranted under this objective than under the National Income or Regional Development objectives. Striving to maintain and improve Environmental Quality

would place greater urgency upon the acquisition at an early date of lands needed to meet foreseeable future demands, for instance, in locations where a build-up of population concentrations was predicted. Advance acquisition of such areas on the basis of recognizable future needs could make it possible to provide opportunities for non-consumptive uses in metropolitan areas when the build-up has occurred. If acquisition is delayed until the need is at hand, the desired lands are generally not available, having either been used for other purposes or driven out of reach, economically, by the skyrocketing of prices accompanying development.

Aids to Implementing Plan

In attempting to reach Regional Development and Environmental Quality objectives, it would be helpful to fish and wildlife agencies in the states to provide for Federal participation in funding operation and maintenance costs of fish and wildlife enhancement features of water resource projects constructed by Federal agencies. Presently, the entire burden of operation and maintenance of such features falls upon the state agency; as a result, relatively few enhancement opportunities have been picked up by the states in connection with construction of such projects in the past; they have not considered it practicable, in view of their generally limited budgets to commit funds for this purpose.

Further encouragement, particularly as regards reaching Environmental Quality goals, could be given to implementation of fish and wildlife enhancement measures if the Federal-State cost-sharing rate on construction of such features were changed from the present 50-50 ratio to 75-25, comparable to that provided by the Federal Aid to Fish and Wildlife Restoration Acts, under which funds can be used to construct single-purpose state fish and wildlife facilities.

Cost-sharing on fish and wildlife facilities refers only to instances in which fish and wildlife resources will be enhanced. The cost of means and measures to prevent loss and damage to such resources resulting from a Federally-constructed water resource project is chargeable to the project. Enhancement measures must be justified (in the case of construction by the Federal Government) by a determination that the benefits -- tangible or intangible, as the case may be -- will equal or exceed the costs. This is not so in regard to the cost of means or measures to prevent loss -- for the obvious reason that no benefit exists. Means and measures to prevent loss are recommended by State and Federal fish and wildlife agencies when they determine that the associated costs are within reason, considering the magnitude and significance of the resource affected.

Concepts in Relation to Fish and Wildlife Projections

Projections used in this report, i.e., to formulate a single-purpose plan for meeting anticipated needs related to fish and wildlife resources, are based on a combination of the socio-economic

objectives described in the foregoing paragraphs but oriented primarily toward the National Income objective. This is because resource capability to meet user-demands and resultant needs, where these occurred, -- all measured in terms of man-days of recreation -- were estimated at present satisfaction levels in terms of success ratios. The needs, therefore, and the man-days of additional capability resulting from solutions for satisfying those needs as presented in this report are minimal values, as shown hypothetically in the following paragraph.

If it is assumed that the resource use-capability in man-days is a function of the success ratio or rate of harvest per unit of hunting or fishing effort, it follows that the use-capability of a given quantity of the resource can vary in magnitude drastically, depending upon the satisfaction level (success ratio) selected. In the hypothesis stated algebraically below, "Y" is the annual sustained yield -- the quantity of the resource that can be "consumed" each year. "X" is the success ratio or rate of harvest (consumption) per man-day required to meet needs satisfactorily under the National Income plan; "a" is an additional amount which must be added in the regional development plan if the region is to compete successfully with other regions; and "b" represents a further increment of success which must be added to achieve a satisfaction level adequate for achieving Environmental Quality goals. "K" represents user demand in man-days.

Average Annual Yield	Need Satisfaction Level	Planning Objective	Man-Days Use Capability	Man-Days Demand	Man-Days Need
Y	X	N.I.	$\frac{Y}{X}$	K	$K - \frac{Y}{X}$
Y	X+a	R.D.	$\frac{Y}{X+a}$	K	$K - \frac{Y}{X+a}$
Y	X+a+b	E.Q.	$\frac{Y}{X+a+b}$	K	$K - \frac{Y}{X+a+b}$

In the following example, the foregoing is applied to a hypothetical warmwater fishery resource in which it is assumed that "X+a" must equal 2X while "X+a+b" must equal 4X, and that there is a demand of 100-man-days/acre.

Average Annual Yield	Need Satis- faction Level	Planning Objective	Man-Days Use Capability	Man-Days Demand	Man-Days Need
100 $\frac{\text{lbs.}}{\text{Acre}}$	1 lb./day	N.I.	100	100	0
100 $\frac{\text{lbs.}}{\text{Acre}}$	2 lb./day	R.D.	50	100	50
100 $\frac{\text{lbs.}}{\text{Acre}}$	4 lb./day	E.Q.	25	100	75

Scheduling Implementation of Plan

In light of the previous section of the report of needs, problems, and possible solutions relative to fish and wildlife resources, it is evident that meeting even the minimal estimates of future needs will require that present capability of existing resources not only be maintained but improved, that measures be taken to assure full use of existing resources on a sustained yield basis, and that every opportunity be taken to create new habitat for production of additional resources.

It should be stressed that, where a solution (i.e., a device) is recommended to meet a certain part of the anticipated demand, implementation of the recommended quantity of that device in the proper time frame within the plan is required. If devices are not implemented in terms of required quantity at or by any given time, complications will be generated and problems compounded. For example, construction of fishing piers and acquisition of areas for public fishing may be a solution to meeting needs for surf or shore fishing. If areas are acquired but no piers are constructed, fishermen will overcrowd the shore areas. Or, if sufficient coldwater stream access is not acquired to properly distribute growing demand for fishing opportunity, fishermen will overcrowd and overfish stream reaches which are accessible. If such conditions persist for long, active participation in trout fishing will probably decline and unsatisfied demand (needs) will increase. In short, whatever devices for meeting needs and included in the plan should be provided in the specified quantity by the specified time in order to be fully effective.

Regarding the timing, moreover, it is important that solutions to problems of anticipated needs be implemented early enough so that supply is kept somewhat ahead of increasing demand (the same principle which is applied to development of public water supplies, power supplies, transportation facilities, etc.) Otherwise, active participation may be adversely affected by crowding, lack of success, etc. If this happens, active participation (but not necessarily demand) may remain static or even decline. While early implementation

may mean that certain facilities will not be fully used for a few years, it would be much better to have it so than to stifle the desires of outdoor recreationists to hunt, fish, or enjoy other wildlife-related activities which it is in the public interest to foster from the standpoint of general welfare, if for no other reason.

Formulation of Fish and Wildlife Plan

In order to put together a regional fish and wildlife plan -- one step in NAR plan formulation -- it is necessary to develop it as three different plans. The first concerned the basins; the second, the Sub-regions; and the third, the North Atlantic Region as a whole. Each has different supply and demand values and, therefore, different needs and solutions.

The Bureau of Sport Fisheries and Wildlife, in cooperation with the National Marine Fisheries Service and the state fish and game agencies within the Region (and after discussions with the other agencies involved in this study), has selected from the possible solutions available what would appear to be the essential elements of a plan best suited to meet fish and wildlife resource-use needs of the future. These elements can be grouped into six major categories or objectives:

a. Conservation and development of existing resources and their ability and availability to provide recreational opportunity;

b. Creation of additional lake type fishing habitat and development of it to obtain maximum productivity, maximum recreational quality, and maximum fishing use;

c. Augmentation of low flow where necessary (other than for pollution dilution) to improve the quantity and quality of stream fisheries;

d. Elimination of pollution in which it is a factor limiting fishing opportunity;

e. Creation and development of additional waterfowl habitat to increase waterfowl production and related recreational opportunities; and

f. Re-establishment of runs of anadromous fishes in certain rivers which historically supported them.

RECREATIONAL FISHERIES - RESIDENT SPECIES

Conservation and Development of Existing Resources

On-going Programs - State and Federal

On-going fish conservation and development programs of the responsible state and Federal agencies will be active most likely regardless of the findings, conclusions, and recommendations -- and implementations -- of the NAR Study. They are acquiring access, hatching and rearing fish, restoring anadromous fisheries, rehabilitating and otherwise improving habitat, constructing new fishing lakes, etc. The impact of these on-going programs was estimated, based upon anticipated performance in the light of past programs, and is reflected in the capabilities that appeared in Table 0-13.

Such programs, however, should also be looked upon as the cornerstone for any fish and wildlife plan prepared in connection with the NAR. The estimated impact, therefore, is shown again but with more specificity in Table 0-28.

Fishery research, in all its many important aspects, is another on-going program, but it was impossible to quantify its impact in terms of resource capability for providing additional fishing opportunities.

On-going Programs - Augmented

Water Supply Reservoirs. The effects of augmented programs to conserve and develop existing fresh-water resources in order to meet future sport-fishery needs are shown in Table 0-29. Primarily, these effects reflect the increased fishing opportunity resulting from an expanded program of access development to existing waters, including presently closed-to-fishing water supply reservoirs and private lakes. The full capability of existing freshwater fisheries to provide fishing opportunity is shown on Table 0-30, together with the potential for additional development in connection with other elements of the NAR plan.

Costs involved for opening water supply reservoirs would include those for parking areas, maintenance, and water treatment. Chlorination at the rate of 10 mg/liter costs $22.00 per million gallons[1/] -- this represents current operations. But full chlorination at a level costing only $4.50 per million gallons would adequately handle any fisherman-related bacterial or coliform build-up. Moreover,

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1/ Excerpt from Draft of Feasibility Report on Alternative Regional Water Supply Plans for Northern New Jersey, New York City, and Western Connecticut Metropolitan Areas, August 1969.

TABLE 0-28

EFFECT OF ON-GOING STATE AND FEDERAL PROGRAMS IN MEETING FUTURE NEEDS RELATED TO SPORTFISHERY RESOURCES
(IN THOUSANDS)

Basin	Type of Use and Resource	Use Capability Existing Resources 1965	Use Capability 1/ Gain from on-going programs 1980	2000	2020	Total Use Capability Anticipated 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by on-going Programs 1980	2000	2020
A-1	Streams													
	Coldwater	30	10	14	8	40	54	62	30	34	40	0	0	0
	Lakes													
	Coldwater	716	247	337	65	963	1,300	1,365	705	824	968	0	0	0
	Total Freshwater	746	257	351	73	1,003	1,354	1,427	735	858	1,008	0	0	0
	Anadromous	-	-	-	-	-	-	-	39	45	53	39	45	53
A-2	Streams													
	Coldwater	22	5	7	7	27	34	41	22	24	30	0	0	0
	Warmwater	11	3	4	4	14	18	22	11	12	15	0	0	0
	Lakes													
	Coldwater	526	128	175	174	654	829	1,003	532	623	729	0	0	0
	Warmwater	494	121	165 2/	0	615	780	780	500	585	685	0	0	0
	Total Freshwater	1,053	257	351	185	1,310	1,661	1,846	1,065	1,244	1,459	0	0	0
	Anadromous	6	25	5	5	31	36	41	56	66	77	25	30	36
A-3	Streams													
	Coldwater	15	5	7	7	20	27	34	19	22	26	0	0	0
	Warmwater	7	3	2	3	10	12	15	10	11	13	0	0	0
	Lakes													
	Coldwater	372	128	175	176	500	675	851	476	554	647	0	0	0
	Warmwater	350	121	165	34	471	636	670	447	521	608	0	0	0
	Total Freshwater	744	257	349	220	1,001	1,350	1,570	952	1,108	1,294	0	0	0
	Anadromous	-	3	0	0	3	3	3	238	277	323	235	274	320
A-4	Streams													
	Coldwater	16	5	7	7	21	28	35	20	22	26	0	0	0
	Warmwater	8	2	3	3	10	13	16	10	11	13	0	0	0
	Lakes													
	Coldwater	413	128	141	0	541	682	682	486	568	660	0	0	0
	Warmwater	388	120	163	161	508	671	832	456	529	620	0	0	0
	Total Freshwater	825	255	314	171	1,080	1,394	1,565	972	1,125	1,319	0	0	0
	Anadromous	-	2	0	0	2	2	2	243	281	330	241	279	328
A-5	Streams													
	Coldwater	19	5	7	9	24	31	40	21	24	29	0	0	0
	Warmwater	10	3	4	4	13	17	21	10	12	14	0	0	0
	Lakes													
	Coldwater	484	136	174	176	620	794	970	525	613	719	0	0	0
	Warmwater	454	127	163	98	581	744	842	493	576	675	0	0	0
	Total Freshwater	967	271	348	287	1,238	1,586	1,873	1,049	1,225	1,437	0	0	0
	Anadromous	161	63	25	29	224	249	278	287	336	394	63	87	116
	Saltwater	460	68	81	81	528	609	690	500	584	685	0	0	0
Sub-Region A	Streams													
	Coldwater	102	30	42	38	132	174	212	112	126	151	0	0	0
	Warmwater	36	11	13	14	47	60	74	41	46	55	0	0	0
	Lakes													
	Coldwater	2,511	767	1,002	591	3,278	4,280	4,871 2/	2,724	3,177	3,723	0	0	0
	Warmwater	1,686	439	656	293	2,175	2,831	3,124	1,896	2,211	2,588	0	0	0
	Total Freshwater	4,335	1,297	1,713	936	5,632	7,345	8,281	4,773	5,560	6,517	0	0	0
	Anadromous	167	93	30	34	260	290	324	863	1,005	1,177	603	715	853
	Saltwater	460	68	81	81	528	609	690	500	584	685	0	0	0

1/ Incremental amounts.

2/ Use made of marginal coldwater lakes.

TABLE 0-28 (Continued)

Basin	Type of Use and Resource	Use Capability Existing Resources 1965	Use Capability 1/ Gain from on-going programs 1980	2000	2020	Total Use Capability Anticipated 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by on-going Programs 1980	2000	2020
B-6	Streams													
	Coldwater	66	5	7	7	71	78	85	76	92	114	5	14	29
	Warmwater	33	3	3	4	36	39	43	38	46	57	2	7	14
	Lakes													
	Coldwater	1,659	133 2/	179 2/	177 2/	1,792	1,971	2,148	1,884	2,318	2,873	92	347	725
	Warmwater	1,560	125	169	167	1,685	1,854	2,021	1,771	2,179	2,700	86	325	679
	Total Freshwater	3,318	266	358	355	3,584	3,942	4,297	3,769	4,635	5,744	185	693	1,447
	Anadromous	-	75	18	23	75	92	116	419	515	638	344	422	522
	Saltwater	870	68	81	81	938	1,019	1,100	989	1,217	1,509	51	198	409
B-7	Streams													
	Coldwater	709	0	0	0	709	709	709	836	1,044	1,293	127	335	584
	Warmwater	131	13	17	16	144	161	177	155	193	239	11	32	62
	Lakes													
	Coldwater	551	55	73	81	606	679	760	650	812	1,005	44	133	245
	Warmwater	1,234	123	163	152	1,357	1,520	1,672	1,455	1,818	2,250	98	298	578
	Total Freshwater	2,625	191	253	249	2,816	3,069	3,318	3,096	3,867	4,787	280	798	1,469
	Anadromous	-	82	20	24	82	102	126	163	204	252	81	102	126
B-8	Streams													
	Coldwater	972	0	0	0	972	972	972	1,323	1,673	2,094	351	701	1,122
	Warmwater	288	20	28	27	308	336	363	392	496	620	84	160	257
	Lakes													
	Coldwater	1,008	71	97	67	1,079	1,176	1,243	1,372	1,735	2,171	293	559	928
	Warmwater	1,332	93	128	124	1,425	1,553	1,677	1,813	2,293	2,869	388	740	1,192
	Total Freshwater	3,600	184	253	218	3,784	4,037	4,235	4,900	6,197	7,754	1,116	2,160	3,499
	Anadromous	120	0	4	16	120	124	140	100	127	158	0	3	18
B-9	Streams													
	Coldwater	620	0	0	0	620	620	620	728	899	1,101	108	279	481
	Warmwater	41	2	3	3	43	46	49	48	60	73	5	14	24
	Lakes													
	Coldwater	1,283	0	0	0	1,283	1,283	1,283	1,504	1,860	2,275	221	577	992
	Warmwater	2,193	132	186	176	2,325	2,511	2,687	2,572	3,179	3,890	247	668	1,203
	Total Freshwater	4,137	134	189	179	4,271	4,460	4,639	4,852	5,998	7,339	581	1,538	2,700
	Anadromous	-	48	6	7	48	54	61	469	582	712	421	528	651
	Saltwater	5,918	68	81	81	5,986	6,067	6,148	6,897	8,529	10,434	911	2,462	4,286
B-10	Streams													
	Coldwater	923	0	0	0	923	923	923	1,049	1,346	1,702	126	423	779
	Warmwater	147	0	0	0	147	147	147	167	214	271	20	67	124
	Lakes													
	Coldwater	566	0	0	0	566	566	566	644	826	1,044	78	260	478
	Warmwater	462	55	78	77	517	595	672	524	673	851	7	78	179
	Total Freshwater	2,098	55	78	74	2,153	2,231	2,308	2,384	3,059	3,868	231	828	1,560
	Anadromous	0	40	3	4	40	43	47	203	261	330	163	218	283
	Saltwater	1,529	68	81	81	1,597	1,678	1,759	1,745	2,239	2,832	148	561	1,073
Sub-Region B	Streams													
	Coldwater	3,290	5	7	7	3,295	3,302	3,309	4,012	5,054	6,304	717	1,752	2,995
	Warmwater	640	38	51	50	678	729	779	800	1,009	1,260	122	280	481
	Lakes													
	Coldwater	5,067	259	349	32[illegible]	5,326	5,675	6,000	6,054	7,551	9,368	728	1,876	3,368
	Warmwater	6,781	528	724	696	7,309	8,033	8,729	8,135	10,142	12,560	826	2,109	3,831
	Total Freshwater	15,778	830	1,131	1,078	16,608	17,739	18,817	19,001	23,756	29,492	2,393	6,017	10,675
	Anadromous	120	245	50	75	365	415	490	1,354	1,689	2,090	989	1,274	1,600
	Saltwater	8,317	204	243	243	8,521	8,764	9,007	9,631	11,985	14,775	1,110	3,221	5,768

1/ Incremental gains.

2/ Use made of marginal coldwater lakes.

TABLE 0-28 (Continued)

Basin	Type of Use and Resource	Use Capability Existing Resources	Use Capability [1/] Gain from on-going programs			Total Use Capability Anticipated			Total Demand Anticipated			Remaining Needs not Met by on-going Programs		
		1965	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
C-11	Streams													
	Coldwater	638	45	61	52	683	744	796	710	814	953	27	70	157
	Warmwater	603	42	58	56	645	703	759	668	766	897	23	63	138
	Lakes													
	Coldwater	603	42	58	56	645	703	759	668	766	897	23	63	138
	Warmwater	1,913	134	184	178	2,047	2,231	2,409	2,130	2,442	2,860	83	211	451
	Total Freshwater	3,757	263	361	342	4,020	4,381	4,723	4,176	4,788	5,607	156	407	884
C-12	Streams													
	Coldwater	387	43	60	59	430	490	549	417	506	610	0	16	61
	Warmwater	364	40	57	55	404	461	516	393	476	574	0	15	58
	Lakes													
	Coldwater	364	40	57	55	404	461	516	393	476	574	0	15	58
	Warmwater	1,160	128	180	176	1,288	1,468	1,644	1,252	1,518	1,830	0	50	186
	Total Freshwater	2,275	251	354	345	2,526	2,880	3,225	2,455	2,976	3,588	0	96	363
	Anadromous	157	58	29	34	215	244	278	273	331	399	58	87	121
C-13	Streams													
	Coldwater	306	43	28	0	349	377	377	345	419	503	0	42	126
	Warmwater	288	40	56	23	328	384	407	325	394	473	0	10	66
	Lakes													
	Coldwater	288	5	0	0	293	293	293	325	394	473	32	101	180
	Warmwater	918	0	0	0	918	918	918	1,036	1,256	1,508	118	338	590
	Total Freshwater	1,800	88	84	23	1,888	1,972	1,995	2,031	2,463	2,957	150	491	962
	Anadromous	-	5	0	0	5	5	5	102	124	149	97	119	144
	Saltwater	13,300	68	81	81	13,368	13,449	13,530	15,247	18,487	22,201	1,879	5,038	8,671
Sub-Region C	Streams													
	Coldwater	1,331	131	149	111	1,462	1,611	1,722	1,472	1,739	2,066	10	128	344
	Warmwater	1,255	122	171	134	1,377	1,548	1,682	1,386	1,636	1,944	9	88	262
	Lakes													
	Coldwater	1,255	87	115	111	1,342	1,457	1,568	1,386	1,636	1,944	44	179	376
	Warmwater	3,991	262	364	354	4,253	4,617	4,971	4,418	5,216	6,198	165	599	1,227
	Total Freshwater	7,832	602	799	710	8,434	9,233	9,943	8,662	10,227	12,152	228	994	2,209
	Anadromous	157	63	29	34	220	249	283	375	455	548	156	206	265
	Saltwater	13,300	68	81	81	13,368	13,449	13,530	15,247	18,487	22,201	1,879	5,038	8,671

1/ Incremental gains.

TABLE 0-28 (Continued)

Basin	Type of Use and Resource	Use Capability Existing Resources	Use Capability [1/] Gain from on-going programs			Total Use Capability Anticipated			Total Demand Anticipated			Remaining Needs not Met by on-going Programs		
		1965	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
D-14	Streams													
	Coldwater	901	0	0	0	901	901	901	994	1,204	1,446	93	303	545
	Warmwater	83	11	15	15	94	109	124	86	105	126	0	0	2
	Lakes													
	Coldwater	445	57	80	68	502	582	650	497	602	723	0	20	73
	Warmwater	511	50	0	0	561	561	561	562	681	817	1	120	256
	Total Freshwater	1,940	118	95	83	2,058	2,153	2,236	2,139	2,592	3,112	94	443	876
	Anadromous	1	5	1	2	6	7	9	12	14	17	6	7	8
D-15	Streams													
	Coldwater	1,930	58	80	62	1,988	2,068	2,130	2,344	2,956	3,690	356	888	1,560
	Warmwater	965	29	40	41	994	1,034	1,075	1,172	1,478	1,845	178	444	770
	Lakes													
	Coldwater	1,367	41	56	59	1,408	1,464	1,523	1,660	2,094	2,613	252	630	1,090
	Warmwater	3,859	116	159	165	3,975	4,134	4,299	4,688	5,911	7,379	713	1,777	3,080
	Total Freshwater	8,121	244	335	327	8,365	8,700	9,027	9,864	12,439	15,527	1,499	3,739	6,500
	Anadromous	345	42	56	67	387	443	510	428	540	674	41	97	164
	Saltwater	650	68	81	81	718	799	880	781	985	1,229	63	186	349
D-16	Streams													
	Coldwater	24	21	28	0	45	73	73	28	35	43	0	0	0
	Warmwater	33	28	38	0	61	99	99	38	48	59	0	0	0
	Lakes													
	Coldwater	78	5	0	0	83	83	83	90	113	139	7	30	56
	Warmwater	171	17	0	0	188	188	188	198	247	305	10	59	117
	Total Freshwater	306	71	66	0	377	443	443	354	443	546	17	89	173
	Anadromous	7	1	1	1	8	9	10	9	11	13	1	2	3
	Saltwater	7,000	68	81	81	7,068	7,149	7,230	7,977	9,971	12,324	909	2,822	5,094
Sub-Region D	Streams													
	Coldwater	2,855	79	108	62	2,934	3,042	3,104	3,366	4,195	5,179	432	1,153	2,075
	Warmwater	1,081	68	93	56	1,149	1,242	1,298	1,296	1,631	2,030	147	389	732
	Lakes													
	Coldwater	1,890	103	136	127	1,993	2,129	2,256	2,247	2,809	3,475	254	680	1,219
	Warmwater	4,541	183	159	165	4,724	4,883	5,048	5,448	6,839	8,501	724	1,956	3,453
	Total Freshwater	10,367	433	496	410	10,800	11,296	11,706	12,357	15,474	19,185	1,557	4,178	7,479
	Anadromous	353	48	58	70	401	459	529	449	565	704	48	102	175
	Saltwater	7,650	136	162	162	7,786	7,948	8,110	8,758	10,956	13,553	972	3,003	5,443

1/ Incremental gains.

TABLE 0-28 (Continued)

Basin	Type of Use and Resource	Use Capability Existing Resources 1965	Use Capability 1/ Gain from on-going programs 1980	2000	2020	Total Use Capability Anticipated 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by on-going Programs 1980	2000	2020
E-17	Streams													
	Coldwater	3,103	93	128	133	3,196	3,324	3,457	3,675	4,591	5,703	479	1,267	2,246
	Warmwater	931	28	38	40	959	997	1,037	1,102	1,377	1,711	143	380	674
	Lakes													
	Coldwater	621	13	26	27	639	665	692	735	918	1,141	96	253	449
	Warmwater	3,103	93	128	133	3,196	3,324	3,457	3,675	4,591	5,703	479	1,267	2,246
	Total Freshwater	7,758	232	320	333	7,990	8,310	8,643	9,187	11,477	14,258	1,197	3,167	5,615
	Anadromous	40	210	57	70	250	307	377	460	574	713	210	267	336
E-18	Streams													
	Warmwater	53 (1,391) 2/	0	0	0	1,444	1,444	1,444	1,633	2,025	2,492	189	581	1,048
	Lakes													
	Warmwater	737	0	0	0	737	737	737	2,351	2,915	3,586	1,614	2,178	2,849
	Total Freshwater	790 (1,391) 2/	0	0	0	2,181	2,181	2,181	3,984	4,940	6,078	1,803	2,759	3,897
	Anadromous	203	67	91	90	270	361	451	226	281	345	0	0	0
	Saltwater	2,403	68	81	81	2,471	2,552	2,633	2,717	3,368	4,144	246	816	1,511
Sub-Region E	Streams													
	Coldwater	3,103	93	128	133	3,196	3,324	3,457	3,675	4,591	5,703	479	1,267	2,246
	Warmwater	2,375	28	38	40	2,403	2,441	2,481	2,735	3,402	4,203	332	961	1,722
	Lakes													
	Coldwater	621	18	26	27	639	665	692	735	918	1,141	96	253	449
	Warmwater	3,840	93	128	133	3,933	4,061	4,194	6,026	7,506	9,289	2,093	3,445	5,095
	Total Freshwater	9,939	232	320	333	10,171	10,491	10,824	13,171	16,417	20,336	3,000	5,926	9,512
	Anadromous	243	277	148	160	520	668	828	686	855	1,058	166	187	230
	Saltwater	2,403	68	81	81	2,471	2,552	2,633	2,717	3,368	4,144	246	816	1,511

1/ Incremental gains.
2/ Using capability of tidal waters. (Totals 1444 and 2181, respectively.)

TABLE 0-28 (Continued)

Basin	Type of Use and Resource	Use Capability 1/ Existing Resources 1965	Use Capability Gain from on-going programs 1980	2000	2020	Total Use Capability Anticipated 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by on-going Programs 1980	2000	2020
F-19	Streams													
	Coldwater	29	0	0	0	29	29	29	359	515	705	330	486	676
	Warmwater	1,162 (489) 2/	0	0	0	1,651	1,651	1,651	2,097	3,004	4,111	446	1,353	2,460
	Lakes													
	Warmwater	947	0	0	0	947	947	947	3,534	5,064	6,931	2,587	4,117	5,984
	Total Freshwater	2,138 (489) 2/	0	0	0	2,627	2,627	2,627	5,990	8,583	11,747	3,363	5,956	9,120
	Anadromous	35	208	98	119	243	341	460	451	646	884	208	305	424
	Saltwater	2,379	68	81	81	2,447	2,528	2,609	3,037	4,353	5,956	590	1,825	3,347
F-20	Streams													
	Coldwater	3	0	0	0	3	3	3	8	10	13	5	7	10
	Warmwater	170	0	0	0	170	170	170	308	402	514	138	232	344
	Lakes													
	Warmwater	379	178	72	0	557	629	629	455	594	759	0	0	130
	Total Freshwater	552	178	72	0	730	802	802	771	1,006	1,286	143	239	484
	Anadromous	160	42	25	35	202	227	262	193	252	322	0	25	60
	Saltwater	226	68	81	81	294	375	456	269	351	448	0	0	0
F-21	Streams													
	Coldwater	21	0	0	0	21	21	21	132	167	209	111	146	188
	Warmwater	626	16	0	0	642	642	642	771	974	1,220	129	332	578
	Lakes													
	Warmwater	1,017	0	0	0	1,017	1,017	1,017	1,299	1,643	2,056	282	626	1,039
	Total Freshwater	1,664	16	0	0	1,680	1,680	1,680	2,202	2,784	3,485	522	1,104	1,805
	Anadromous	139	207	98	87	346	444	531	552	697	871	206	253	340
	Saltwater	1,832	68	81	81	1,900	1,981	2,062	2,276	2,875	3,599	376	894	1,537
Sub-Region F	Streams													
	Coldwater	53	0	0	0	53	53	53	499	692	927	446	639	874
	Warmwater	2,447	16	0	0	2,463	2,463	2,463	3,176	4,380	5,845	713	1,917	3,382
	Lakes													
	Warmwater	2,343	178	72	0	2,521	2,593	2,593	5,288	7,301	9,746	2,767	4,708	7,153
	Total Freshwater	4,843	194	72	0	5,037	5,109	5,109	8,963	12,373	16,518	3,926	7,264	11,309
	Anadromous	334	457	221	241	791	1,012	1,253	1,196	1,595	2,077	405	583	824
	Saltwater	4,437	204	243	243	4,641	4,884	5,127	5,582	7,579	10,003	941	2,695	4,876

1/ Incremental gains.

2/ Lowered satisfaction level and use made of tidal freshwater species. (Will provide 1651 man-days and 2627 man-days, respectively.)

TABLE O-29

EFFECTS OF AUGMENTING ON-GOING STATE-FEDERAL PROGRAMS IN MEETING FUTURE NEEDS RELATED TO SPORTFISHERY RESOURCES

(Figures in thousands)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs			Gain in Use Capability from Augmented Programs			Total Use Capability of Fishery Resources			Total Demand Anticipated			Remaining Needs not Met by Conservation & Development		
		1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
A-1	Anadromous	0	0	0	25	29	34	25	29	34	39	45	53	14	16	19
	Anadromous 1/	0	0	0	25	29	34	25	29	34	25	29	34	0	0	0
A-2	Anadromous	31	36	41	25	30	36	56	66	77	56	66	77	0	0	0
	Anadromous 1/	31	36	41	205	240	284	236	276	325	236	276	325	0	0	0
A-3	Anadromous	3	3	3	0	0	0	3	3	3	238	277	323	235	274	320
	Anadromous 1/	3	3	3	0	0	0	3	3	3	153	178	207	150	175	204
A-4	Anadromous	2	2	2	0	0	0	2	2	2	243	281	330	241	279	328
	Anadromous 1/	2	2	2	0	0	0	2	2	2	156	182	215	154	180	213
A-5	Anadromous	224	249	278	63	87	116	287	336	394	287	336	394	0	0	0

1/ Transferring demand between basins.

TABLE 0-29 (Continued)

Basin	Type of Use and Resource	Total Use Capability With On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
B-6	Streams															
	Coldwater	71	78	85	5	14	29	76	92	114	76	92	114	0	0	0
	Warmwater	36	39	43	2	7	14	38	46	57	38	46	57	0	0	0
	Lakes															
	Coldwater	1,792	1,971	2,148	92	347	725	1,884	2,318	2,873	1,884	2,318	2,873	0	0	0
	Warmwater	1,685	1,854	2,021	86 2/	325 2/	679 2/	1,771	2,179	2,700	1,771	2,179	2,700	0	0	0
	Total Freshwater	3,584	3,942	4,297	185	693	1,447	3,769	4,635	5,744	3,769	4,635	5,744	0	0	0
	Anadromous	75	93	116	75	92	115	150	185	231	419	515	638	269	330	407
	Anadromous 1/	75	93	116	75	92	115	150	185	231	150	185	231	0	0	0
	Saltwater	938	1,019	1,100	51	198	409	989	1,217	1,509	989	1,217	1,509	0	0	0
B-7	Streams															
	Coldwater	709	709	709	0	0	0	709	709	709	838	1,044	1,293	127	335	584
	Warmwater	144	161	177	11	32	62	155	193	239	155	193	239	0	0	0
	Lakes															
	Coldwater	606	679	760	44	133	245	650	812	1,005	650	812	1,005	0	0	0
	Warmwater	1,357	1,520	1,672	98	298	578	1,455	1,818	2,250	1,455	1,818	2,250	0	0	0
	Total Freshwater	2,816	3,069	3,318	153	463	885	2,969	3,532	4,203	3,096	3,867	4,787	127	335	584
	Anadromous	82	102	126	81	102	126	163	204	252	163	204	252	0	0	0
	Anadromous 1/	82	102	126	574	676	652	656	778	778	656	826	1,029	0	48	251
B-8	Streams															
	Coldwater	972	972	972	0	0	0	972	972	972	1,323	1,673	2,094	351	701	1,122
	Warmwater	308	336	363	84	160	257	392	496	620	392	496	620	0	0	0
	Lakes															
	Coldwater	1,079	1,176	1,243	293	352	285	1,372	1,528	1,528	1,372	1,735	2,171	0	207	643
	Warmwater	1,425	1,553	1,677	388	740	1,192	1,813	2,293	2,869	1,813	2,293	2,869	0	0	0
	Total Freshwater	3,784	4,037	4,255	765	1,252	1,734	4,549	5,289	5,989	4,900	6,197	7,754	351	908	1,765
	Anadromous	120	124	140	0	3	18	120	127	158	100	127	158	0	0	0
	Anadromous 1/	120	124	140	324	320	373	444	444	513	288	381	513	0	0	0
B-9	Streams															
	Coldwater	620	620	620	0	0	0	620	620	620	728	899	1,101	108	279	481
	Warmwater	43	46	49	5	14	24	48	60	73	48	60	73	0	0	0
	Lakes															
	Coldwater	1,283	1,283	1,283	220	220	220	1,503	1,503	1,503	1,504	1,860	2,275	1	357	772
	Warmwater	2,325	2,511	2,687	247	668	1,149	2,572	3,179	3,836	2,572	3,179	3,890	0	0	54
	Total Freshwater	4,271	4,460	4,639	472	902	1,393	4,743	5,362	6,032	4,852	5,998	7,339	109	636	1,307
	Anadromous	48	54	61	22	27	33	70	81	94	469	582	712	399	501	618
	Anadromous 1/	48	54	61	22	27	33	70	81	94	70	81	94	0	0	0
	Saltwater	5,986	6,067	6,148	911	2,462	4,286	6,897	8,529	10,434	6,897	8,529	10,434	0	0	0
B-10	Streams															
	Coldwater	923	923	923	0	0	0	923	923	923	1,049	1,346	1,702	126	423	779
	Warmwater	147	147	147	0	0	0	147	147	147	167	214	271	20	67	124
	Lakes															
	Coldwater	566	566	566	78	260	478	644	826	1,044	644	826	1,044	0	0	0
	Warmwater	517	595	672	7	78	179	524	673	851	524	673	851	0	0	0
	Total Freshwater	2,153	2,231	2,308	85	338	657	2,238	2,569	2,965	2,384	3,059	3,868	146	490	903
	Anadromous	40	43	47	8	11	14	48	54	61	203	261	330	155	207	269
	Anadromous 1/	40	43	47	8	11	14	48	54	61	48	54	61	0	0	0
	Saltwater	1,597	1,678	1,759	148	561	1,073	1,745	2,239	2,832	1,745	2,239	2,832	0	0	0

1/ Transferring demand between basins.
2/ Convert to combination coldwater lakes.

TABLE 0-29 (Continued)

Basin	Type of Use and Resource	Total Use Capability With On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
C-11	Streams															
	Coldwater	683	744	796	27	52	0	710	796	796	710	814	953	0	18	157
	Warmwater	645	703	759	23	63	138	668	766	897	668	766	897	0	0	0
	Lakes															
	Coldwater	645	703	759	23	63	138	668	766	897	668	766	897	0	0	0
	Warmwater	2,047	2,231	2,409	83	211	451	2,130	2,442	2,860	2,130	2,442	2,860	0	0	0
	Total Freshwater	4,020	4,381	4,723	156	389	727	4,176	4,770	5,450	4,176	4,788	5,607	0	18	157
C-12	Streams															
	Coldwater	430	490	549	0	16	61	430	506	610	417	506	610	0	0	0
	Warmwater	404	461	516	0	15	58	404	476	574	393	476	574	0	0	0
	Lakes															
	Coldwater	404	461	516	0	15	58	404	476	574	393	476	574	0	0	0
	Warmwater	1,288	1,468	1,644	0	50	186	1,288	1,518	1,830	1,252	1,518	1,830	0	0	0
	Total Freshwater	2,526	2,880	3,225	0	96	363	2,526	2,976	3,588	2,455	2,976	3,588	0	0	0
	Anadromous	215	244	278	58	87	121	273	331	399	273	331	399	0	0	0
	Anadromous 1/	215	244	278	155	206	266	370	450	544	370	450	544	0	0	0
C-13	Streams															
	Coldwater	349	377	377	0	0	0	349	377	377	345	419	503	0	42	126
	Warmwater	328	384	407	0	10	0	328	394	407	325	394	473	0	0	66
	Lakes															
	Coldwater	293	293	293	0	0	0	293	293	293	325	394	473	32	101	180
	Warmwater	918	918	918	118	338	590	1,036	1,256	1,508	1,036	1,256	1,508	0	0	0
	Total Freshwater	1,888	1,972	1,995	118	348	590	2,006	2,320	2,585	2,031	2,463	2,957	25	143	373
	Anadromous	5	5	5	0	0	0	5	5	5	102	124	149	97	119	144
	Anadromous 1/	5	5	5	0	0	0	5	5	5	5	5	5	0	0	0
	Saltwater	13,368	13,449	13,530	1,879	5,038	8,671	15,247	18,487	22,201	15,247	18,437	22,201	0	0	0

1/ Transferring demand between basins.

TABLE 0-29 (Continued)

Basin	Type of Use and Resource	Total Use Capability With On-Going Programs			Gain in Use Capability from Augmented Programs			Total Use Capability of Fishery Resources			Total Demand Anticipated			Remaining Needs not Met by Conservation & Development		
		1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
D-14	Streams															
	Coldwater	901	901	901	0	0	0	901	901	901	994	1,204	1,446	93	303	545
	Warmwater	94	109	124	0	0	2	94	109	126	86	105	126	0	0	0
	Lakes															
	Coldwater	502	582	650	0	20	73	502	602	723	497	602	723	0	0	0
	Warmwater	561	561	561	1	120	256	562	681	817	562	681	817	0	0	0
	Total Freshwater	2,058	2,153	2,236	1	140	331	2,059	2,293	2,567	2,139	2,594	3,112	80	301	545
	Anadromous	6	7	9	6	7	8	12	14	17	12	14	17	0	0	0
D-15	Streams															
	Coldwater	1,988	2,068	2,130	356	374	312	2,344	2,442	2,442	2,344	2,956	3,690	0	514	1,248
	Warmwater	994	1,034	1,075	178	444	770	1,172	1,478	1,845	1,172	1,478	1,845	0	0	0
	Lakes															
	Coldwater	1,408	1,464	1,523	252	630	1,090	1,660	2,094	2,613	1,660	2,094	2,613	0	0	0
	Warmwater	3,975	4,134	4,299	713	1,731	1,566	4,688	5,865	5,865	4,688	5,911	7,379	0	46	1,514
	Total Freshwater	8,365	8,700	9,027	1,499	3,179	3,738	9,864	11,879	12,765	9,864	12,439	15,527	0	560	2,762
	Anadromous	387	443	510	41	97	164	428	540	674	428	540	674	0	0	0
	Saltwater	718	799	880	63	186	349	781	985	1,229	781	985	1,229	0	0	0
D-16	Streams															
	Coldwater	45	73	73	0	0	0	45	73	73	28	35	43	0	0	0
	Warmwater	61	99	99	0	0	0	61	99	99	38	48	59	0	0	0
	Lakes															
	Coldwater	83	83	83	8	8	8	91	91	91	90	113	139	0	22	43
	Warmwater	188	188	188	10	46	46	198	234	234	198	247	305	0	13	71
	Total Freshwater	377	443	443	18	54	54	395	497	497	354	443	546	0	0	49
	Anadromous	8	9	10	1	2	3	9	11	13	9	11	13	0	0	0
	Saltwater	7,068	7,149	7,230	909	2,822	5,094	7,977	9,871	12,324	7,977	9,971	12,324	0	0	0

TABLE 0-29 (Continued)

Basin	Type of Use and Resource	Total Use Capability With On-Going Programs			Gain in Use Capability from Augmented Programs			Total Use Capability of Fishery Resources			Total Demand Anticipated			Remaining Needs not Met by Conservation & Development		
		1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
E-17	Streams															
	Coldwater	3,196	3,324	3,457	479	1,267	2,245	3,675	4,591	5,702	3,675	4,591	5,703	0	0	1
	Warmwater	959	997	1,037	143	380	674	1,102	1,377	1,711	1,102	1,377	1,711	0	0	0
	Lakes															
	Coldwater	639	665	692	96	253	449	735	918	1,141	735	918	1,141	0	0	0
	Warmwater	3,196	3,324	3,457	479	1,267	1,930	3,675	4,591	5,387	3,675	4,591	5,703	0	0	316
	Total Freshwater	7,990	8,310	8,643	1,197	3,167	5,298	9,187	11,477	13,941	9,187	11,477	14,258	0	0	317
	Anadromous	250	307	377	210	267	336	460	574	713	460	574	713	0	0	0
E-18	Streams															
	Warmwater	1,444	1,444	1,444	189	383	383	1,633	1,827	1,827	1,633	2,025	2,492	0	198	665
	Lakes															
	Warmwater	737	737	737	282	282	282	1,019	1,019	1,019	2,351	2,915	3,586	1,332	1,896	2,567
	Total Freshwater	2,181	2,181	2,181	471	665	665	2,652	2,846	2,846	3,984	4,940	6,078	1,332	2,094	3,232
	Anadromous	270	361	451	0	0	0	270	361	451	226	281	345	0	0	0
	Saltwater	2,471	2,552	2,633	246	816	1,511	2,717	3,368	4,144	2,717	3,368	4,144	0	0	0

TABLE 0-29 (Continued)

Basin	Type of Use and Resource	Total Use Capability With On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
F-19	Streams															
	Coldwater	29	29	29	0	0	0	29	29	29	359	515	705	330	486	676
	Warmwater	1,651	1,651	1,651	446 1/	1,353 1/	2,067 1/	2,097	3,004	3,718	2,097	3,004	4,111	0	0	393
	Lakes															
	Warmwater	947	947	947	174	174	174	1,121	1,121	1,121	3,534	5,064	6,931	2,413	3,943	5,810
	Total Freshwater	2,627	2,627	2,627	620	1,527	2,241	3,247	4,154	4,868	5,990	8,583	11,747	2,743	4,429	6,879
	Anadromous	243	341	460	208	306	424	451	647	884	451	646	884	0	0	0
	Saltwater	2,447	2,528	2,609	590	1,505	1,424	3,037	4,033	4,033	3,037	4,353	5,956	0	320	1,922
F-20	Streams															
	Coldwater	3	3	3	0	0	0	3	3	3	8	10	13	5	7	10
	Warmwater	170	170	170	0	0	0	170	170	170	308	402	514	138	232	344
	Lakes															
	Warmwater	557	629	629	0	0	76	557	629	705	455	594	759	0	0	54
	Total Freshwater	730	802	802	0	0	76	730	802	878	771	1,006	1,286	41	204	408
	Anadromous	202	227	262	0	25	60	202	252	322	193	252	322	0	0	0
	Saltwater	294	375	456	0	0	0	294	375	456	269	351	418	0	0	0
F-21	Streams															
	Coldwater	21	21	21	0	0	0	21	21	21	132	167	209	111	146	188
	Warmwater	642	642	642	0	0	0	642	642	642	771	974	1,220	129	332	578
	Lakes															
	Warmwater	1,017	1,017	1,017	175	175	175	1,192	1,192	1,192	1,299	1,643	2,056	107	451	864
	Total Freshwater	1,680	1,680	1,680	175	175	175	1,855	1,855	1,855	2,202	2,784	3,485	347	929	1,630
	Anadromous	346	444	531	206	183	96	552	627	627	552	697	871	0	70	244
	Saltwater	1,900	1,981	2,062	214	133	52	2,114	2,114	2,114	2,276	2,875	3,599	162	761	1,485

1/ Reduced satisfaction level and use made of tidal freshwater spp.

TABLE 0-30
TOTAL SPORTFISHERY CAPABILITY - FISH AND WILDLIFE PLAN
(Thousands of man-days)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 4/	Maximum Potential: Existing Resource 1/	Additional Development Potential 2/
A-1	Streams			
	Coldwater	30	180	-
	Lakes			
	Coldwater	716	1,365	-
	Total Freshwater	746	1,545	-
	Anadromous		-	41 3/
A-2	Streams			
	Coldwater	22	555	-
	Warmwater	11	89	-
	Lakes			
	Coldwater	526	3,150	-
	Warmwater	494	645	-
	Total Freshwater	1,053	4,439	-
	Anadromous		6	1,424 3/
A-3	Streams			
	Coldwater	15	36	-
	Warmwater	7	18	-
	Lakes			
	Coldwater	372	1,500	-
	Warmwater	350	670	-
	Total Freshwater	744	2,224	-
	Anadromous		3	944 3/
A-4	Streams			
	Coldwater	16	62	-
	Warmwater	8	32	-
	Lakes			
	Coldwater	413	682	-
	Warmwater	388	952	-
	Total Freshwater	825	1,728	-
	Anadromous		2	540 3/
A-5	Streams			
	Coldwater	19	90	-
	Warmwater	10	28	-
	Lakes			
	Coldwater	484	1,953	-
	Warmwater	454	842	-
	Total Freshwater	967	2,913	-
	Anadromous		161	979 3/
	Saltwater	460	3,491	-

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

4/ Capability of Existing Resources, Table 0-28.

TABLE O-30 (Continued)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 4/	Maximum Potential: Existing Resource 1/	Additional Development Potential 2/	
B-6	Streams				
	Coldwater	66	295		-
	Warmwater	33	370		-
	Lakes				
	Coldwater	1,659	7,893		-
	Warmwater	1,560	1,560		-
	Total Freshwater	3,318	10,118		-
	Saltwater	870	3,264		-
	Anadromous		12		594 3/
B-7	Streams				
	Coldwater	709	709		-
	Warmwater	131	256		-
	Lakes				
	Coldwater	551	7,678		-
	Warmwater	1,234	2,559		-
	Total Freshwater	2,625	11,202		-
	Anadromous		30		778 3/
B-8	Streams				
	Coldwater	972	972		-
	Warmwater	288	931		-
				Opening water supply reservoirs	Opening water supply reservoirs and private lakes
	Lakes				
	Coldwater	1,008	1,243	1,518	1,528
	Warmwater	1,332	3,590	4,368	4,397
	Total Freshwater	3,600	6,736	-	
	Anadromous		120	2,136 3/	-
B-9	Streams				
	Coldwater	620	620		
	Warmwater	41	155	-	
	Lakes				
	Coldwater	1,283	1,283	1,503	
	Warmwater	2,193	2,996	3,836	
	Total Freshwater	4,137	5,054	-	
	Anadromous		26	281 3/	
	Saltwater	5,918	22,193		
B-10	Streams				
	Coldwater	923	923	-	
	Warmwater	147	147	-	
	Lakes				
	Coldwater	566	566	896	1,463
	Warmwater	462	1,498	1,946	2,270
	Total Freshwater	2,098	3,134	-	
	Anadromous		31	460 3/	
	Saltwater	1,529	5,734	-	

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

4/ Capability of Existing Resources, Table O-28.

TABLE 0-30 (Continued)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 4/	Maximum Potential: Existing Resource 1/	Additional Development Potential 2/
C-11	Streams			
	Coldwater	638	796	-
	Warmwater	603	1,052	-
	Lakes			
	Coldwater	603	3,726	-
	Warmwater	1,913	7,039	-
	Total Freshwater	3,757	12,613	-
C-12	Streams			
	Coldwater	387	760	-
	Warmwater	364	1,005	-
	Lakes			
	Coldwater	364	1,659	-
	Warmwater	1,160	3,134	-
	Total Freshwater	2,275	6,558	-
	Anadromous		157	1,320 3/
C-13	Streams			
	Coldwater	306	377	-
	Warmwater	288	407	-
	Lakes			Opening water supply reservoirs
	Coldwater	288	293	293
	Warmwater	918	918	1,582
	Total Freshwater	1,800	1,995	-
	Anadromous		5	9 3/
	Saltwater	13,300	50,000	-

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

4/ Capability of Existing Resources, Table 0-28.

TABLE O-30 (Continued)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 4/	Maximum Potential: Existing Resource 1/	Additional Development Potential 2/: Opening water supply reservoirs	Additional Development Potential 2/: Opening water supply reservoirs and private lakes
D-14	Streams				
	Coldwater	901	901	-	
	Warmwater	83	249	-	
	Lakes				
	Coldwater	445	650	1,473	1,620
	Warmwater	511	561	961	1,057
	Total Freshwater	1,940	2,361	-	-
	Anadromous		1	200 3/	
D-15	Streams				
	Coldwater	1,930	2,442	-	
	Warmwater	965	2,632	-	
	Lakes				
	Coldwater	1,367	2,685	3,294	3,623
	Warmwater	3,859	4,346	5,332	5,865
	Total Freshwater	8,121	12,105	-	-
	Anadromous		345	3,808 3/	
	Saltwater	650	2,438	-	
D-16	Streams				
	Coldwater	24	457	-	
	Warmwater	33	494	-	
	Lakes				
	Coldwater	78	83	83	91
	Warmwater	171	188	213	234
	Total Freshwater	306	1,222	-	-
	Anadromous		7	235 3/	-
	Saltwater	7,000	26,250	-	

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

4/ Capability of Existing Resources, Table O-28.

TABLE 0-30 (Continued)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 5/	Maximum Potential: Existing Resource 1/	Additional Development Potential 2/: Opening water supply reservoirs	Additional Development Potential 2/: Opening water supply reservoirs and private lakes
E-17	Streams				
	Coldwater	3,103	5,702	-	
	Warmwater	931	5,262	-	
	Lakes				
	Coldwater	621	1,500	1,756	1,932
	Warmwater	3,103	4,225	4,897	5,387
	Total Freshwater	7,758	16,689	-	-
	Anadromous		40	2,849 3/	
E-18	Streams				
	Warmwater	1,444 4/	53	[1,774 4/]	
	Lakes				
	Warmwater	737	737	998	1,019
	Total Freshwater	2,181 4/	790	-	-
	Anadromous		588	2,733 3/	
	Saltwater	2,403	6,478	-	

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

4/ Includes freshwater fish in tidal waters.

5/ Capability of Existing Resources, Table 0-28.

TABLE O-30 (Continued)

Basin	Fish Habitat Class	Capability: Existing Resource 1965 6/	Maximum Potential: Existing Resource 1/		Additional Development Potential 2/
F-19	Streams				
	Coldwater	29	92		-
	Warmwater	1,651	1,162 (2,324)*		-
			[1,394 4/]		
			3,718		
				Opening water supply reservoirs	Opening water supply reservoirs and private lakes
	Lakes				
	Warmwater	947	947	1,016	1,121
	Total Freshwater	(2,627)	2,138	-	
	Anadromous		35	884 3/	
	Saltwater	2,379	4,033	6,632 5/	
F-20	Streams				
	Coldwater	3	3	-	
	Warmwater	170	170	-	
	Lakes				
	Warmwater	379	629	-	705
	Total Freshwater	552	802	-	
	Anadromous		202	1,093 3/	
	Saltwater	226	1,119	-	
F-21	Streams				
	Coldwater	21	21	-	
	Warmwater	626	642	-	
	Lakes				
	Warmwater	1,017	1,017	-	1,192
	Total Freshwater	1,664	1,680	-	
	Anadromous		139	627 3/	
	Saltwater	1,832	2,114	3,449 5/	

1/ Measure of the pressure that fishery resources could support under present environmental conditions, assuming public access development to productive habitat.

2/ Not evaluated unless required for meeting fishery needs; stream habitat excludes pollution abatement and low-flow augmentation.

3/ Includes full fishery development of all waters, based on natural reproduction (Pollution abatement, fishway construction or dam removal, minimum flows, initial stocking and fishermen access).

* Reduced satisfaction level to 1/2 lb.

4/ Includes freshwater fish in tidal waters.

5/ Pollution abatement

6/ Capability of Existing Resources, Table O-28.

safety requires that most, if not all, surface water supply systems receive chemical treatment whether or not fishing is permitted. It does not seem, therefore, that all of the treatment cost associated with opening reservoirs to fishing use should be charged against that activity.

Making privately-owned lakes available for public fishing use would entail acquisition of permanent easements or purchase of all or a part of the contiguous lands in fee simple. All in all, however, if it can be accomplished, this still represents one of the least expensive devices for "creating new" fishery resources to meet public needs.

Access Facilities. In estimating the amount of access facilities required to accommodate projected demands for fresh-water fishing for resident species, a "typical" fisherman-access facility was envisioned -- one which could be expected to provide at least the minimum requirements to meet needs throughout the North Atlantic Region. There is sufficient flexibility in design to permit modification in accordance with the many and varied situations under which this device would be used.

In this basic design, the basic unit was a parking area with frontage on the fishable water area, thus guaranteeing public access to the shore. The following formula was used to compute design load in terms of capacity for parking vehicles:

$$DL = \frac{\frac{0.8 \times \text{fisherman-days}}{26}}{2 \times 2.5} \times 0.6 = .00369 \text{ fisherman-days}$$

The unit of access was a one acre area capable of providing parking space for 50 cars with boat trailers or 100 cars only. Each area would have an access road, boat-launching ramp, and sanitary facilities. These units could, of course, be of lesser size or be combined as necessary, considering the amount of use to which they would be subjected.

Using the above formula the total area in acres that would accommodate the projected needs was determined. To this amount was added one more acre per unit to accommodate the access road and other facilities.

Costs of this "typical" parking facility were estimated to be as follows:

Item	Capital Cost
Gravelled parking area (one acre one foot deep)	$ 5,000
Access road (1,000 feet by 20 feet, gravelled)	2,000
Boat-launching ramp (gravelled)	3,000
Toilet (pit-type, frame) two per unit	1,000
Land clearing and site preparation	2,000
Contingencies and engineering	5,000
TOTAL FOR EACH UNIT	$18,000

The estimated cost of the land required was added to the above to obtain the total investment figure. This was then computed as an annual cost, using an amortization rate of 5 1/8 per cent for 50 years. These are minimum costs; additional costs would be required to provide access strips along stream banks or lake shores or, where necessary, to acquire rights to wade the stream. Greater costs would also accompany more intensive developments involving additional or more expensive boat-launching ramps, fishing piers, picnic tables, etc.

These recommended access areas should, to the extent possible, be distributed in accordance with the following concepts. The Bureau of Outdoor Recreation publication titled The 1965 Survey of Outdoor Recreation Activities states that over 2/3 (68%) of fishing activity occurs in the course of one-day trips. Distance is a limiting factor in determining what available resources will receive the most use, other things being more or less equal. The recommended fishery access facilities, therefore, should be located with regard for demand distribution patterns. Although fishermen do not constitute as large a percentage of the total population in Standard Metropolitan Statistical Areas (SMSA's) as elsewhere, the concentration of population in such areas makes it safe to say that most of the fishing demand originates there. Facilities, therefore, should be distributed in the following percentage pattern according to the distance of the available resources from SMSA centers, insofar as possible. The goal should also be, of course, to attempt to provide the relative abundance of fishing opportunities in essentially this same pattern. This concept should serve as a guide to investment of available funds, which is what the NAR and other comprehensive studies are basically all about, anyway.

Relative Demand at Various Distances from Population Centers

Number of Miles					
5 or less	6 to 10	10 to 25	25 to 50	50 to 100	Over 100
18%	15%	29%	22%	12%	4%

Creation and Development of Additional Lake-type Fisheries

Amount Required

In addition to conservation and development of existing resources, so as to realize fully their capability for meeting needs, additional opportunities for lake fishing should be created by construction of dams at suitable locations in basins where needs exist. Table 0-31 shows the estimated surface acreage of impounded waters required to meet these needs in each basin to the extent the physiography of each will permit, within each of the time frames of the study.

As mentioned previously, much unused fishery habitat in the form of private lakes and water supply reservoirs presently exists. If the fishing public continues to be denied the use of these fisheries, then construction of more impoundments would be advantageous, but undoubtedly this is the most expensive of the solutions.

Construction, that is, investments in construction should be in accord with the fishing opportunity demand pattern in relation to SMSA's, as previously discussed in connection with establishment of access sites.

Table 0-31 also contains benefit figures in terms of additional man-days of fishing opportunity resulting from impoundment construction. These are potential benefits which could only be realized if, in addition to the construction of the lakes, there were commensurate effort to develop and manage the fisheries. Losses in fishing opportunity and impact upon wildlife resources due to inundation of existing habitat have not been evaluated at this point. It has been assumed that, in the course of more detailed planning, any such losses would be mitigated to a degree which would render them insignificant. Any "either or" situations, of course would have to be decided upon the basis of the paramount needs or desires of the people involved.

Development for Optimum Use

Access. As mentioned in the preceding paragraph, development and management will be essential to realizing the full potential of reservoir fisheries. Provisions for adequate parking area for cars and boat trailers, together with construction of boat-launching ramps, are fundamental measures in development.

Fish Attractors. Under certain conditions or in certain situations, fish attractors can improve fishing, particularly in the case of warm-water fisheries. Details of design, location, and the type of construction and materials to be used will need to be worked out in the course of detailed project planning. Cost is estimated to be an average of $100 per unit which, on the basis of past experience,

appears reasonable. As a rule of thumb, the number required to achieve satisfactory results averages about one attractor for each 60 surface acres of water surface. It is estimated that these devices will provide sufficiently better fishing success so as to increase annual use of the fishery by 30 to 40 fisherman-days per unit (For the purpose of this report, the number was set at 33 -- three units per 100 fisherman days). On the basis of better quality angling (improved success ratio) attributable to these devices, the additional use was assigned a value of $1.50 per day.

Fishing Piers. In a somewhat similar manner, fishing piers located at strategic points around the lake shore will provide higher quality recreation and attract additional fishing use. It is estimated that such additional use will average 4,500 man-days annually per pier. On the basis of improved recreational quality, these additional fisherman-days can be assigned a unit value of $4.00 for trout fishing and $3.00 for warm-water angling.

These piers will cost $45,000 each for initial construction. Amortized over a 50-year period at the rate of 5 1/8 percent (as has been done in connection with determination of the annual costs of all investments mentioned in this report), this amounts to an annual cost of $2,500 per pier. Added to this would be the amount of $1,500 to cover annual costs of operation, maintenance, and replacement. Total annual costs, therefore, are estimated to be $4,000.

Zoning. There are many conflicting uses of reservoir areas which interfere with development of the maximum potential fishing-use. Water-based recreation such as power boating, water skiing and, to a lesser extent, swimming frequently limits the use of waters for fishing. It is, therefore, essential that adequate balance be maintained between the various water uses to insure maximum overall use. Zoning of portions of each reservoir that has a satisfactory fishery to control power boating and skiing is essential.

Legislative Constraints

It should be mentioned that where fishery benefits justify the cost of a project either for single or multiple-purpose use, then such projects should be considered for authorization. This is especially needed for upstream impoundments constructed by the Soil Conservation Service.

Under existing Federal law and policy, however, it is unlikely that many of these reservoirs would be considered justified for construction with Federal funds solely on the basis of fish and wildlife values. In view of the recreational needs to be met and the economic benefits which could accrue from increased fishing activity in the basins, it is hoped that the attention of the Congress will be directed toward this situation at such time as it may be considering implementation of projects in the North Atlantic Region.

Improvement of Stream Fisheries

General Discussion

Principally, increased stream habitat can be accomplished through two alternatives. These alternatives are low-flow augmentation and pollution abatement. The quantity of habitat required is the important prerequisite, so that these alternatives can be used singularly or in combination to produce the desired effect. The quantity of stream habitat required to meet the needs of the stream fisherman is shown in Table 0-31.

The cost of obtaining the desired effect by pollution abatement would vary in each individual area, depending upon the pollutant and the required treatment costs. The cost of low-flow augmentation will depend upon the cost of creating storage and control for the amount of water required.

Minimum Flow Requirements

Establishment of an effective level of instantaneous minimun flow -- a biological floor, so to speak -- is essential to maintenance of satisfactory stream fisheries, even though under normal conditions this level of flow would in most cases occur infrequently. In a study of the scope and intensity of this North Atlantic Regional undertaking, only a very broad indication of what these flows should be can be attempted. In the case of the Connecticut River, the Technical Committee for Connecticut River Fisheries (comprised of representatives from the States of Connecticut, Massachusetts, New Hampshire, and Vermont and from the United States Fish and Wildlife Service and the National Marine Fisheries Service) has recommended that the flow past the main stem dams should be not less than .25 cubic feet per second per square mile of drainage area. Because of similar drainage and rainfall distribution patterns compared with other river basins in the northeastern portion of the NAR, it is reasonable to conclude that this figure represents the order of magnitude of the instantaneous minimum flow required in that section. Conditions in the southernmost Sub-regions indicate on the same basis that the instantaneous minimum flow to be maintained for streams in their basins would be on the order of .20 cubic feet per square mile of drainage area.

As a preliminary estimate, therefore, minimum flows in the above csm quantitites or natural flow conditions, whichever may be higher, can be considered a prerequisite to maintaining satisfactory fish habitat. These flows must also have adequate temperature and oxygen levels and be of adequate quality in other respects, according to the kind of fishery they support.

In order to achieve low-flow benefits for cold-water stream fisheries, the temperature of the augmentation flow should range between 55° and 70°F. Where spawning and rearing habitat is involved,

TABLE 0-31

SUMMARY OF RECREATIONAL FISHERIES PLAN:

ACCESS AND FRESHWATER SUPPLY REQUIREMENTS AND RELATED BENEFITS IN MAN-DAYS

(Represents incremental increases)

TOTAL SUB-REGION A

	Basin														
	1			2			3			4			5		
Fish habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Anadromous Acres	6	1	2	4	1	1	36	6	8	36	6	8	10	4	4
Man-Days	39	6	8	25	5	5	235	39	46	241	38	49	63	25	29

TABLE 0-31 (CONTINUED)
SUB-REGION A PLAN II TRANSFERRING DEMAND BETWEEN BASINS
ANADROMOUS SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin														
	1			2			3 1/			4 1/			5		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Anadromous															
Acres	4	1	1	32	6	8	[23	4	5]	[23	4	5]	10	4	4
Man-Days	25	4	5	205	35	45	[150	25	29]	[154	24	31]	63	25	29

1/ Not suggested in plan.

TABLE 0-31 (Continued)

TOTAL SUB-REGION A

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
	Acres	Man-days	Acres	Man-days	Acres	Man-days
Anadromous	92	603	18	113	23	137

TABLE 0-31 (Continued)

SUB-REGION B
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

Fish Habitat Class	Basin 6 1980	Basin 6 2000	Basin 6 2020	Basin 7 1980	Basin 7 2000	Basin 7 2020	Basin 8 1980	Basin 8 2000	Basin 8 2020	Basin 9 1980	Basin 9 2000	Basin 9 2020	Basin 10 1980	Basin 10 2000	Basin 10 2020
Streams															
Coldwater Acres	1	1	2	18	30	36	52	52	62	16	26	30	18	44	1/
Man-Days	5	9	15	127	208	249	351	350	421	108	171	202	126	297	(356)
Warmwater Acres	1	1	1	2	4	4	12	12	14	1	1	1	2	8	8
Man-Days	2	5	7	11	26	25	84	76	97	5	9	10	20	47	57
Lakes															
Coldwater Acres	14	38	56	6	14	16	41	40	54	32	52	62	12	26	32
Man-Days	92	255	378	44	89	112	293	266	369	221	356	415	78	182	218
Warmwater Acres	12*	36*	52*	16	30	42	60	52	68	36	64	80	1	10	16
Man-Days	86	239	354	98	200	280	388	352	452	247	421	535	7	71	101
Total Freshwater Acres	28	76	111	42	78	98	165	156	198	85	143	173	33	86	56
Man-Days	185	508	754	280	523	666	1,116	1,044	1,339	581	957	1,162	231	597	376
Anadromous Acres	50	12	15	12	3	4	-	1	2	39	-	-	24	8	10
Man-Days	344	78	100	81	21	24		3	15	259 (162)2/	(107)2/	(123)2/	163	55	65
Saltwater Acres	8	21	32							134	228	271	21	60	76
Shore or Surf Acres	118	330	484							671	1,141	1,346	107	306	375
Total Saltwater Acres	126	351	516							805	1,369	1,617	128	366	451
Fishing Piers (feet)	-	-	-							22,400	38,800	46,000	3,600	10,200	12,900
Man-Days	51	144	211							911	1,551	1,824	148	413	512

*Convert to combination coldwater lakes.

1/ Unsat. demand convert to coldwater ponds.

2/ Satisfy by transfer to other basins (unsatisfied demand).

TABLE 0-31 (Continued)

SUB-REGION B PLAN II TRANSFERRING DEMAND AND/OR CONVERTING
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin														
	6			7			8			9			10		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams															
Coldwater Acres				(Same)									18	44	-
Man-Days													126	297	-
Lakes															
Coldwater Acres													12	26	84
Man-Days													78	182	574
Total Freshwater Acres													33	86	106
Man-Days													231	597	732
Anadromous Acres	12	3	4	84	22	26	48	-	8	3	1	1	2	1	1
Man-Days	75	18	23	574	150	179	324	-	49	22	5	6	8	3	3

TABLE 0-31 (Continued)

SUB-REGION B FRESHWATER SUPPLY REQUIREMENTS

POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin														
	6			7			8			9			10		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams															
Coldwater Acres				900	1,600	1,900	2,600	2,600	3,100	800	1,300	1,500	900	2,200	1/
Man-Days				127	208	249	351	350	421	108	171	202	126	297	(356)
Warmwater Acres													600	1,500	1,800
Man-Days													20	47	57

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS

(IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	6			7			8			9			10		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes															
Coldwater (man-days)							129	363	436	221	356	415	78	182	218
Water Supply Acres							1,200	1,300		2,000	2,000		700	1,700	600
Private Acres								100							1,400
Impoundment Acres								2,300	4,000		1,200	3,800			
Warmwater (man-days)											183	711			
Water Supply Acres											3,300	11,700			
Private Acres															
Impoundment Acres												1,000			

1/ Move or convert (unsatisfied demand).

TABLE 0-31 (Continued)

SUB-REGION B PLAN II CONVERTING DEMAND
FRESHWATER SUPPLY REQUIREMENTS
POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin														
	6			7			8			9			10		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams															
Coldwater Acres				900	1,600	1,900	2,600	2,600	3,100	800	1,300	1,500	900	2,200	-
Man-Days				127	208	249	351	350	421	108	171	202	126	297	
Warmwater Acres													600	1,500	1,800
Man-Days													20	47	57

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin														
	6			7			8			9			10		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes															
Coldwater (man-days)							129	363	436	221	356	415	78	182	574
Water Supply Acres							1,200	1,300		2,000	2,000		700	1,700	600
Private Acres								100							4,600
Impoundment Acres								2,300	4,000		1,200	3,800			
Warmwater (man-days)											183	711			
Water Supply Acres											3,300	11,700			
Private Acres															
Impoundment Acres												1,000			

TABLE 0-31 (Continued)

TOTAL SUB-REGION B

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENT INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	105	717	153	1,035	130	887
Warmwater	18	122	24	163	28	196
Lakes						
Coldwater	105	728	170	1,148	220	1,492
Warmwater	125	826	192	1,283	258	1,722
Total Freshwater	353	2,393	539	3,629	636	4,297
Anadromous	125	847	24	157	31	204
Saltwater	163		209		379	
Shore or Surf	896		1,777		2,205	
Total Saltwater	1,059	1,110	2,086	2,111	2,584	2,547
Fishing Piers (feet)	26,000		49,000		58,900	

TABLE 0-31 (Continued)

TOTAL SUB-REGION B
FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	5,200	493	7,700	1,026	6,500	872
Lakes						
Warmwater					6,400	357

TABLE 0-31 (Continued)

SUB-REGION C

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	11			12			13		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	4	7	13		2	7			
Man-Days	27	43	87		13	45		(42)1/	(84)1/
Warmwater Acres	4	6	11		2	6		2	
Man-Days	23	40	75		15	43		10	(56)1/
Lakes									
Coldwater Acres	4	6	11		2	6			
Man-Days	23	40	75		15	43	(32)1/	(69)1/	(79)1/
Warmwater Acres	12	19	35		8	20	18	32	38
Man-Days	83	128	240		50	136	118	220	252
Total Freshwater Acres	24	38	70		14	39	18	34	38
Man-Days	156	251	477		96	267	118	230	252
Anadromous Acres				9	4	5			
Man-Days				58	29	34	(97)1/	(22)1/	(26)1/
Saltwater Acres							279	468	537
Shore or Surf Acres							1,390	2,337	2,678
Total Saltwater Acres							1,669	2,805	3,215
Man-Days							1,879	3,159	3,633
Fishing Piers (feet)							47,500	79,700	91,300

1/ Unsatisfied demand - move to another basin or alternative devices.

NOTE: Needs for Basin C-13 were distributed in accordance with current information on distances fishermen will travel to fish because of the scarcity of habitat and also on the basis of physical availability of sites for additional impoundments.

According to M. I. Bevins in "Characteristics of Hunters and Fishermen in Six Northeastern States", Northeast Regional Research Publication, October 1968, 69% of New Yorkers fish only within that State, and since a surplus of fishing opportunity exists within the Hudson River Basin (Basin C-12), the unsatisfied demand in Basin C-13 was diverted to Basin C-12. Travel was on basis of one day trips.

TABLE 0-31 (Continued)

SUB-REGION C PLAN II TRANSFERRING DEMAND
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	11			12			13		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres					5	11		(4)	(8)
Man-Days		(Same)			33	79		[25]*	[50]*
Warmwater Acres					2	9		1	(6)
Man-Days					15	59		10	[40]*
Lakes									
Coldwater Acres				1	6	12	(2)	(6)	(6)
Man-Days				2	43	75	[19]*	[41]*	[47]*
Warmwater Acres					8	20	18	32	38
Man-Days					50	136	118 1/	220 1/	252 1/
Total Freshwater Acres				1	21	52	20	43	58
Man-Days				2	141	349	137	296	386
Anadromous Acres				22	8	8	-	-	-
Man-Days				155	51	60	-	-	-

*Need greatly increased fish stocking, fish for fun, lower the satisfaction level etc.........then more access.

NOTE: Development of facilities in the lower portion of the Hudson River Basin (C-13) would benefit people in C-12 also. The fisherman distribution formula shows that about 60% of the unsatisfied fishermen in C-12 would not or could not travel the distance to good fishing in the Upper Hudson River Basin. The plan, therefore, calls for greatly increased stocking in waters of the Lower Hudson River Basin. The economics involved suggest "fish for fun" areas would be a good management measure. Another would be to lower the creel limit. If these measures were adopted, they should be accompanied by provisions for increased public access facilities and/or expansion of of existing facilities.

TABLE 0-31 (Continued)

SUB-REGION C

FRESHWATER SUPPLY REQUIREMENTS

POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	11			12			13		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	-	100	400	-	-	-	-	-	-
Man-Days		18	139						

OPEN WATER SUPPLY RESERVOIRS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	11			12			13		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes									
Warmwater Acres	-	-	-	-	-	-	1,200	2,200	2,500
Man-Days							118	220	252

TABLE 0-31 (Continued)

TOTAL SUB-REGION C

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-Days	Acres	Man-Days	Acres	Man-Days
Streams						
Coldwater	4	27	9	59	20	132
Warmwater	4	23	10	65	17	118
Lakes						
Coldwater	4	23	8	55	17	118
Warmwater	30	201	59	398	93	628
Total Freshwater	42	274	86	577	147	996
Anadromous	9	58	4	29	5	34
Saltwater	279		468		537	
Shore or Surf	1,390		2,337		2,678	
Total Saltwater	1,669	1,879	2,805	3,159	3,215	3,633
Fishing Piers (feet)	47,500		79,700		91,300	

TABLE 0-31 (Continued)

TOTAL SUB-REGION C

FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS (REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-Days	Acres	Man-Days	Acres	Man-Days
Streams						
Coldwater			100	18	400	139
Lakes						
Warmwater	1,200	118	2,200	220	2,500	252

TABLE 0-31 (Continued)

SUB-REGION D

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	14			15			16		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	14	32	36	53	78	67			
Man-Days	93	210	242	356	532	672			
Warmwater Acres			1	26	40	48			
Man-Days			2	178	266	326			
Lakes									
Coldwater Acres		2	8	38	56	68	1	4	4
Man-Days		20	53	252	378	460	7	23	26
Warmwater Acres	-	18	20	105	157	192	2	8	8
Man-Days	1	119	136	713	1,064	1,303	10	49	58
Total Freshwater Acres	14	52	65	222	331	375	3	12	12
Man-Days	94	349	443	1,499	2,240	2,761	17	72	84
Anadromous Acres	1	1	1	7	8	10	1	1	1
Man-Days	6	1	1	41	56	67	1	1	1
Saltwater Acres				10	18	24	134	282	338
Shore or Surf Acres				46	90	121	669	1,409	1,680
Total Saltwater Acres				56	108	145	803	1,691	2,018
Man-Days				63	123	163	909	1,913	2,272
Fishing Piers (feet)				1,600	3,100	4,100	22,800	48,000	57,400

TABLE 0-31 (Continued)

SUB-REGION D
FRESHWATER SUPPLY REQUIREMENTS
POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	14			15			16		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	300	600	700		1,400	2,000			
Man-Days	93	210	242		514	734			

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS (IN SURFACE ACRES)
AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	14			15			16		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes									
Coldwater Man-Days			73				7	23	26
Water Supply Acres			200						
Private Acres							30		
Impoundment Acres								100	100
Warmwater Man-Days		119	136	342	1,223	1,468	10	49	58
Water Supply Acres		1,200	1,400	3,400	6,500		100	150	
Private Acres					5,300			200	
Impoundment Acres					400	14,700		150	600

TABLE 0-31 (Continued)

TOTAL SUB-REGION D

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	67	449	110	742	103	914
Warmwater	26	178	40	266	49	328
Lakes						
Coldwater	39	259	62	421	80	539
Warmwater	107	724	183	1,232	220	1,497
Total Freshwater	239	1,610	395	2,661	452	3,301
Anadromous	9	48	10	58	12	69
Saltwater	144		300		362	
Shore or Surf	715		1,499		1,801	
Total Saltwater	859	972	1,799	2,036	2,163	2,435
Fishing Piers (feet)	24,400		51,100		61,500	

TABLE 0-31 (Continued)

TOTAL SUB-REGION D

FRESHWATER SUPPLY REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

Fish Habitat Class	1980		2000		2020	
	Acres	Man-Days	Acres	Man-Days	Acres	Man-Days
Streams						
Coldwater	300	93	2,000	724	2,700	976
Lakes						
Coldwater	30	7	100	23	300	99
Warmwater	3,500	353	13,900	1,391	16,700	1,662
Total Freshwater *						3,497

* When freshwater is considered as a unit there are no needs for increased supply until 2020.

TABLE 0-31 (Continued)

SUB-REGION E

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS (REPRESENTS INCREMENTAL INCREASES)

	17			18		
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Streams						
Coldwater Acres	71	117	144	-	-	-
Man-Days	479	788	979			
Warmwater Acres	22	35	44	1/	1/	1/
Man-Days	143	237	294	(1,580)	(392)	(467)
Lakes						
Coldwater Acres	13	24	28	-	-	-
Man-Days	96	157	196			
Warmwater Acres	71	117	144	238	84	100
Man-Days	479	788	979	1,614	564	671
Total Freshwater Acres	177	293	360	238	84	100
Man-Days	1,197	1,970	2,448	1,614	564	671
Anadromous Acres	31	8	10			
Man-Days	210	57	70			
Saltwater Acres				36	84	103
Shore or Surf Acres				179	422	513
Total Saltwater Acres				215	506	616
Man-Days				246	570	695
Fishing Piers (feet)				6,100	14,300	17,500

1/ Unsatisfied demand - move to other basins or convert to warmwater ponds; will use freshwater tidal waters.

TABLE 0-31 (Continued)

SUB-REGION E PLAN II TRANSFERRING AND CONVERTING DEMAND
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin					
	17			18		
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Streams						
Coldwater Acres	71	117	144			
Man-Days	479	788	979			
Warmwater Acres	22	46	69	28 1/	32	
Man-Days	143	309 3/	481 3/	189	211	
Lakes						
Coldwater Acres	13	24	28			
Man-Days	96	157	196			
Warmwater Acres	71	117	144	238	100	140
Man-Days	479	788	979	1,614	673 2/	951 2/
Total Freshwater Acres	177	304	385	266	132	140
Man-Days	1,197	2,042	2,632	1,803	884	951

1/ By using tidal waters capability of 1,774 man-days [118,000 acres].
2/ Includes 60% of unsatisfied demands for warmwater streams converted to warmwater ponds.
3/ Includes 40% of unsatisfied demand from Basin 18.

TABLE 0-31 (Continued)

SUB-REGION E

FRESHWATER SUPPLY REQUIREMENTS

POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin					
		17			18	
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Streams						
Warmwater Acres				1,100	-	-
Man-Days				17	-	-

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

		17			18	
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Lakes						
Warmwater Man-Days		366	1,112	1,614	564	671
Water Supply Acres		3,700	3,000	8,700		
Private Acres			6,000	300		
Impoundment Acres			3,000	18,000	7,500	9,000

TABLE 0-31 (Continued)

SUB-REGION E PLAN II CONVERTING DEMAND
FRESHWATER SUPPLY REQUIREMENTS
POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES)
AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin					
	17			18		
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Streams						
Warmwater Acres				1/	1,100	
Man-Days					17	

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS
(IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin					
	17			18		
Fish Habitat Class	1980	2000	2020	1980	2000	2020
Lakes	(Same)					
Warmwater Man-Days				1,614	673	951
Water Supply Acres				8,700		
Private Acres				300		
Impoundment Acres				18,000	9,000	12,700

1/ Using capability of tidal waters.

TABLE 0-31 (Continued)

TOTAL SUB-REGION E

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

Fish Habitat Class	1980 Acres	1980 Man-Days	2000 Acres	2000 Man-Days	2020 Acres	2020 Man-Days
Streams						
Coldwater	71	479	117	788	144	979
Warmwater	22	143	35	237	44	294
Lakes						
Coldwater	13	96	24	157	28	196
Warmwater	309	2,093	201	1,352	244	1,650
Total Freshwater	415	2,811	377	2,534	460	3,119
Anadromous	31	210	8	57	10	70
Saltwater	36		84		103	
Shore or Surf	179		422		513	
Total Saltwater	215	246	506	570	616	695
Fishing Piers (feet)	6,100		14,300		17,500	

TABLE 0-31 (Continued)

TOTAL SUB-REGION E
FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-Days	Acres	Man-Days	Acres	Man-Days
Streams						
Coldwater	1,100	17				
Lakes						
Warmwater	27,000	1,614	11,200	930	21,000	1,783
Total Freshwater *						2,857

* When freshwater is considered as a unit there are no needs for increased supply until 2020.

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TABLE 0-31 (Continued)

SUB-REGION F
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres				1	1	1			
Man-Days				5	2	3			
	(330)1/	(156)1/	(190)1/				(111)1/	(35)1/	(42)1/
Warmwater Acres									
Man-Days									
	(935)1/	(907)1/	(1,107)1/	(138)1/	(94)1/	(112)1/	(129)1/	(203)1/	(246)1/
Lakes									
Warmwater Acres	380	226	276			19	42	50	60
Man-Days	2,587	1,530	1,867			130	282	344	413
Total Freshwater Acres	380	226	276	1	1	20	42	50	60
Man-Days	2,587	1,530	1,867	5	2	133	282	344	413
Anadromous Acres	31	14	18		4	6	31	6	12
Man-Days	208	98	119		25	35	206	47	87
Saltwater Acres	88	182	224				56	76	94
Shore or Surf Acres	436	912	1,121				278	379	474
Total Saltwater Acres	524	1,094	1,345				334	455	568
Man-Days	590	1,235	1,522				376	518	643
Fishing Piers (feet)	15,000	31,000	38,100				9,500	12,900	16,000

1/ Unsatisfied demand - move to another basin or convert to pond fishing.

TABLE 0-31 (Continued)

SUB-REGION F PLAN II TRANSFERRING AND CONVERTING DEMAND
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	46	20	26	1	1	1	12	3	4
Man-Days	305 1/	140 1/	171 1/	5	2	3	82 1/	21 1/	25 1/
Warmwater Acres	66 2/	134 2/	122 2/	2			8		
Man-Days	446	907	830	6			56		
Lakes									
Warmwater Acres	380	226	312 3/	4	24 3/	40 3/	48 3/	62 3/	64 3/
Man-Days	2,587	1,530	2,116	30	161	277	326	422	439
Total Freshwater Acres	492	380	460	7	25	41	68	65	68
Man-Days	3,338	2,577	3,117	41	163	280	464	443	464

1/ Provided greatly increased trout stocking rates to supply demand.
2/ Lowered sat. level and use made of tidal freshwater species.
3/ Converted from warmwater streams.

NOTE: Basin 19's warmwater stream capability was based initially upon a satisfaction level of one pound per man-day. This created a huge unsatisfied demand which could not be met. Since the service area of this basin is predominantly urban, it was necessary to consider ½-pound per day an acceptable level of satisfaction. Needs, however, would still appear by the year 2000; it was necessary, therefore, (as part of the supply) freshwater species inhabiting the tidal area. This, along with other elements recommended in the plan, made it possible to satisfy the needs.

TABLE 0-31 (Continued)

SUB-REGION F
FRESHWATER SUPPLY REQUIREMENTS
POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	1,280			14	6	8	600		
Man-Days	82			5	2	3	39		
Warmwater Acres	5,600			700			4,800		
Man-Days	58			6			56		

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS (IN SURFACE ACRES)
AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes									
Warmwater Man-Days	2,587	1,530	1,867			130	282	344	413
Water Supply Acres	2,300								
Private Acres	1,500					1,100	2,500		
Impounded Acres	32,000	20,000	25,000			700	1,400	4,600	5,500

TABLE 0-31 (Continued)

SUB-REGION F PLAN II CONVERTING DEMAND, TRANSFERRING ETC.

FRESHWATER SUPPLY REQUIREMENTS

POLLUTION ABATEMENT AND/OR LOW-FLOW AUGMENTATION (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Streams									
Coldwater Acres	1,280				(Same)				
Man-Days	82								
Warmwater Acres	5,600 1/								
Man-Days	116								

OPEN WATER SUPPLY RESERVOIRS, PRIVATE LAKES AND/OR CONSTRUCT ADDITIONAL IMPOUNDMENTS (IN SURFACE ACRES)

AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	Basin								
	19			20			21		
Fish Habitat Class	1980	2000	2020	1980	2000	2020	1980	2000	2020
Lakes									
Warmwater Man-Days	2,587	1,530	2,116		191	277	326	422	439
Water Supply Acres	2,300								
Private Acres	1,500				1,100		2,500		
Impoundment Acres	32,000	20,000	28,300		2,100	3,700	2,000	5,600	5,900

1/ Lowered satisfaction level.

TABLE 0-31 (Continued)

TOTAL SUB-REGION F
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	1	5	1	2	1	3
Warmwater						
Lakes						
Warmwater	422	2,869	276	1,874	355	2,410
Total Freshwater	423	2,874	277	1,876	356	2,413
Anadromous	62	414	24	170	36	241
Saltwater	144		258		318	
Shore or Surf	714		1,291		1,595	
Total Saltwater	858	966	1,549	1,753	1,913	2,165
Fishing Piers (feet)	24,500		43,900		54,100	

TABLE 0-31 (Continued)

TOTAL SUB-REGION F PLAN II TRANSFERRING & CONVERTING DEMAND
SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	59	392 1/	24	163 1/	31	199 1/
Warmwater	76	508	134	907	122	830
Lakes						
Warmwater	432	2,943	312	2,113	416	2,832
Total Freshwater	567	3,843	470	3,183	569	3,861

1/ Greatly increased stocking rates to available habitat.

TABLE 0-31 (Continued)

TOTAL SUB-REGION F
FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	1,894	126				
		[320] 1/		[193] 1/		[235] 1/
Warmwater	11,100	120				
		[1,081] 1/		[1,204] 1/		[1,465] 1/
Lakes						
Warmwater	39,700	2,869	24,600	1,874	32,300	2,410
Total Freshwater		4,517		3,271		4,110

1/ Unsatisfied demands - may be converted to warmwater lake fishing or transferred to another basin. (Reduce satisfaction level; greatly increase trout stocking).

TABLE 0-31 (Continued)

TOTAL SUB-REGION F

PLAN II

TRANSFERRING & CONVERTING DEMAND

FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS
(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	1,894	126				
Warmwater	11,100	178				
Lakes						
Warmwater	40,300	2,913	28,800	2,143	37,900	2,832

TABLE 0-31 (Continued)

NAR TOTAL

SPORTFISHERY ACCESS REQUIREMENTS (IN ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

	1980		2000		2020	
Fish Habitat Class	Acres	Man-days	Acres	Man-days	Acres	Man-days
Streams						
Coldwater	248	1,677	390	2,626	398	2,915
Warmwater	70	466	109	731	138	936
Lakes						
Coldwater	161	1,106	264	1,781	345	2,345
Warmwater	993	6,713	911	6,139	1,170	7,907
Total Freshwater	1,472	9,962	1,674	11,271	2,051	14,108
Anadromous	328	2,122	88	584	117	755
Saltwater	766		1,419		1,699	
Shore or Surf	3,894		7,226		8,792	
Total Saltwater	4,660	5,173	8,645	9,629	10,491	11,505
Fishing Piers (feet)	128,500		238,000		283,300	

TABLE 0-31 (Continued)

NAR TOTAL

FRESHWATER SUPPLY REQUIREMENTS (IN SURFACE ACRES) AND ANNUAL NEEDS/OR BENEFITS IN THOUSAND MAN-DAYS

(REPRESENTS INCREMENTAL INCREASES)

Fish Habitat Class	1980		2000		2020	
	Acres	Man-Days	Acres	Man-Days	Acres	Man-Days
Streams						
Coldwater	8,494	948	9,806	1,770	9,608	1,990
Warmwater	12,200	137				
Lakes						
Coldwater	3,900	428	8,600	901	9,800	1,069
Warmwater	71,400	4,953	55,200	4,598	85,200	6,818

the dissolved oxygen level should not be less than 7 mg/liter. The storage reservoir for augmentation flows should be constructed with multilevel or bottom outlet, to facilitate maintenance of the desired habitat conditions in the stream.

In order to achieve warm-water low-flow augmentation benefits, a minimum instantaneous release having a temperature range of 60° - 80°F. will be required. These should have a D.O. level of 5 mg/liter. A multiple-level of surface release could produce the desired benefit.

Water Quality Control

Many miles of stream habitat in the North Atlantic Region are polluted to the extent that water quality is unsuited for game fishes. In areas where water pollution is a factor limiting fishery resources and/or the use made of these resources, water quality should be improved. This could provide both increased quality and quantity of fishery habitat. Increased supplies of sport fishery resources produced in this habitat will help in meeting the needs of the stream fisherman. Fishery benefits will, therefore, result.

Generally speaking, water (following treatment) should have a dissolved oxygen level adequate for the type of fishery involved for maintaining desirable game fish populations. The minimum level of dissolved oxygen to support a warm-water stream biota capable of providing attractive sport-fishing opportunities is considered to be 5 mg/liter and for a cold-water biota, 6 mg/liter, with 7 mg/liter required in reaches used by trout for spawning. Provisions for low-flow augmentation (after maximum possible BOD reduction at the source) should be adequate to bring dissolved oxygen to the respective levels stated above in reaches otherwise suitable as either warm-water or cold-water game-fish habitat.

Other Measures for Meeting Sport-Fishing Needs

As mentioned in the preceding Chapter titled "Problems, and Possible Solutions", there are other measures available for meeting needs which cannot be satisfied through the foregoing plan elements. These other measures become important where it appears unlikely that needs can be satisfied because of lack of habitat. These include conversion and satisfying demand in nearby basins.

Conversion may be defined as substituting one fishery experience with another that is thought similar in desirability. Thus, cold-water pond fishing may be substituted for cold-water stream fishing and warm-water lake fishing for warm-water stream fishing. Also, as mentioned in the status section of the report, certain cold-water lakes can be considered "marginal" habitat and, therefore, may be classified as combination lakes which can support warm-water and cold-water fisheries.

Satisfying the demand in another basin is also possible. Two requirements, however, must be satisfied. First, an adequate resource supply must be available in the second basin, and second, this basin must be located within a reasonable distance from that in which the demand exists. Fishermen are willing to travel a certain distance for a desirable fishing experience. This distance factor has been established, as discussed in the foregoing section in this Chapter titled Conservation and Development of Existing Resources On-going Programs Augmented, Access Facilities. Generally stated, the closer the supply to the demand -- the higher the active participation.

It is realized that incorporation of the above-mentioned solutions may result in certain adverse effects. Where transfer to another basin is listed as an alternative, this choice could result in a certain economic loss to the basin where the demand originated. The choice of conversion could result in loss of stream type habitat to lake type habitat. The effect would be to have a landscape dotted with impoundments with a paucity of flowing streams.

A decision must be made when filling unsatisfied demand as to what alternative to adopt or what mix would be desirable. For planning purposes in this study, we have assumed SMSA's as the central market areas. From these areas, fishermen distribution patterns were evaluated. Based on these fishermen distribution patterns, however, a certain percentage of the demand would not or could not travel beyond certain distances. If these latter fishermen, therefore, cannot find suitable fishing opportunity within their range of travel limitations, they will constitute an unsatisfied demand. By using other solutions, however, even these fishermen can be satisfied.

These solutions include fish-for-fun programs, where either the fish are not actually removed or a low limit is set. Other possibilities include lowering the creel limit (physical) or lowering the satisfaction level (psychological). Increased use could also be made of the lower tidal sections of rivers, where certain fresh-water species occur.

Another alternative is to greatly increase present stocking rates for trout and other cold-water species, and to either salvage warm-water fish or raise channel catfish, carp, etc. for stocking. These stocked fishery resources will support what is known as a put-and-take fishery. The potential benefits and economics of such an alternative appear very promising as the following paragraphs show.

It costs approximately $1.50 per pound to raise and distribute catchable-sized trout. Maintaining a harvest rate of 50 percent and a satisfaction level of one-half pound of trout to satisfy a fisherman-day, therefore, would cost $1.50 a day. A cold-water trout fisherman, however, is willing to pay a minimum of $3.00 a day. So it would cost $1.50 to gain a benefit of $3.00, or a benefit-cost ratio of 2:1.

It is estimated that a pound of catchable-sized channel catfish will cost $.80 to raise and distribute. Assuming a harvest rate of 50 percent and a satisfaction level of 1 lb. to satisfy a fisherman-day, it would cost $1.60 to stock the required weight of fish. A warm-water fisherman is willing to pay $2.00 a day. It will, therefore, cost $1.60 to gain a benefit of $2.00 or a B:C ratio of 1.3:1.

A combination of these stocking programs would prove very beneficial, particularly within an urban area. Almost any body of water that could support fish could be stocked. Trout could be stocked during the cooler months of the spring and fall, with channel catfish supplying the recreation during the warmer summer period.

These same waters could be stocked on a put-and-take basis with other warm-water fish that could be salvaged from other waters. Examples of such waters where salvage operations appear practicable would be closed water supply reservoirs, inaccessible or remote water areas, waters that are overpopulated with resultant stunted fish or having unfavorable species composition, or even polluted waters which carry fish populations. (Raising channel catfish in the cooler regions of the NAR presents problems because of poor fish growth during the winter; so perhaps these fish could be raised in the cooling ponds of thermal generating plants).

By using the above alternative solutions, the present fishery habitat could support increased fishing pressure. In addition to these alternative solutions, increased public access for fishing will be required to provide for the anticipated increased pressure. This public access can either be newly created or increased by expanding existing facilities.

In order to meet the needs of the fisherman, many of the above solutions were adopted in the fish plan. These alternatives can be seen in reviewing the individual basin plans shown in Table 0-31.

RECREATIONAL FISHERIES -- ANADROMOUS

Conservation and Development of Existing Resources

General Discussion

Because of the high value of anadromous species to both sport and commercial fishermen, a major goal of this study was to evaluate the potential to re-establish runs of anadromous fish in those rivers that previously supported significant runs of these species.

The development potential of the anadromous fishery was

estimated by use of the following procedure. Because of the presently limited spawning opportunities for anadromous species in the North Atlantic Region, future potential fishery populations that could be expected from restored use of the rivers' productive nursery and spawning habitat were estimated. This was accomplished by a proportion using the Penobscot, Connecticut, and Hudson drainage areas as the knowns. In these rivers, preliminary studies of potential anadromous fish habitat had been made. The development potentials (capabilities), which are shown in Table 0-30, were projected from these.

It should be pointed out that although full development of the anadromous fishery supply potential may not be required for meeting the demand of the sport fisherman, the surplus supply can be harvested by the commercial fisherman. A measure of this source of supply has been computed for the development potential estimate of the commercial fish supply.

As mentioned above, the development potential of re-establishing an anadromous fishery was based on natural production for the purpose of this report. Natural production is dependent upon the amount of productive habitat available.

Certain alternative solutions are available for meeting needs in excess of the natural productive capability. These solutions mainly include fish stocking and habitat improvement. Spawning and nursery habitat, especially, can be improved both in quantity and quality. This improvement can be accomplished by low-flow augmentation, gravel cleaning, and construction of spawning channels. Additional fishery management techniques that increase the managed species' food supply and/or decrease predation on these species will be beneficial.

Unrestricted access by migrating fish to nursery and spawning hatitat is required in order to realize the development potential. This will involve alleviation of pollution, incorporation of fish passage facilities, and removal or breaching of obsolete dams.

Pollution is the primary limiting factor in eliminating and reducing anadromous runs in certain rivers. Pollution abatement in these rivers should, therefore, receive the highest priority.

In addition to pollution, there are physical barriers to fish migration in many of the above rivers. Most of these barriers are in the form of dams. Fish passage facilities are, therefore, needed to allow fish to pass these obstructions.

On-going Programs -- State and Federal

The on-going programs are essentially the same as those mentioned previously under "Recreational Fisheries -- Resident," and

therefore, will not be repeated here. In addition to these programs, a major effort is being made to construct fish passage facilities. These fish passage facilities enable the fish to negotiate barriers that are presently hindering their upstream migration.

Because of the present high priority program for anadromous fish restoration, it was generally assumed that one-half of the capability could be achieved within the projected time frame. The effects of the on-going state and federal program for increasing the supply of anadromous fish were shown in Table 0-28.

On-going Programs -- Augmented

Introduction. The augmented program represents a stepped-up implementation of devices now being provided by on-going programs to provide for the sport fishery demand. The effect of this program was shown in Table 0-29. That table also showed the effects of transferring demands between basins. This aspect will be covered in greater detail in the section titled "Fisherman Access Facilities" in this section.

Fish Passage Facilities. The construction of fish passage facilities in particular is a program element that warrants augmentation. The estimated cost of fish passage facilities was determined by the following method. The number and respective heights of dams requiring fish passage facilities were abstracted from published material. A rough estimate of probable cost was supplied by our engineers -- \$6,000 per vertical foot for concrete facilities constructed at low head dams, and \$10,000 per foot for high dams. Annual maintenance costs for any properly designed facility should be something less than one per cent of the initial cost.

It should be pointed out that these estimates are probably minimum figures. The cost of providing cofferdams to divert river flows during the construction phase of building fish ladders and the associated costs of providing fish attraction flows and collection facilities could raise estimates by 50 per cent.

Many of the dams, however, are licensed by the Federal Power Commission, and it is expected in such instances that each licensee will bear the cost of fish passage devices at his dam or dams. With the advent of more economical power, many of these hydro-projects may be abandoned and can be removed or the dams breached.

The estimated cost for construction of fish-passage facilities on rivers having anadromous fisheries potential, by basin, is as follows:

Basin	$$ Cost (in millions)	Basin	$$ Cost (in millions)
A-1	0.5	B-6	3.5
A-2	1.0	B-7	4.0
A-3	5.0 1/	B-8	21.0
A-4	2.0 1/	B-10	0.7
A-5	2.8	E-17	3.0

The above information is an order of magnitude estimate for devices to permit fishes to pass present obstructions both going upstream and down, opening the major portion of each river's productive nursery and spawning areas. Future construction that obstructs fish passage will require that such devices be made a part of the structural design from its inception. It is possible -- and quite probable -- that increased hatchery fish, particularly the Atlantic salmon, may reduce dependence upon natural spawning beds, but fish-passage devices will still be necessary from the standpoint of providing maximum distribution of opportunities to angle for the anadromous species and to facilitate downstream migration.

Fisherman Access Facilities. In addition to successful reestablishment of anadromous fisheries, opportunity must be given to the sport fisherman to harvest these resources -- he must have access to them. The estimated amount of anadromous fishery access has been developed by the same methodology as described previously for resident fresh-water fisheries. The location of these access facilities would depend, of course, upon where and when the fisheries were restored. For American shad, access points should primarily be located downstream from dams and obstructions or channel restrictions (constrictions) that serve to concentrate the fish. For salmon, access should be at those pools which will provide fishing opportunities. Access facilities for white perch and striped bass fishermen should be concentrated along the lower sections of the rivers. These access facilities should be distributed outward from the market area, primarily SMSA's, in the same proportion as fishermen-distribution patterns.

The specialized nature of anadromous fishing means that people will be willing to travel farther to pursue this sport. The demand was, therefore, distributed by overnight recreation trips. This demand was distributed to those rivers having the greatest fishery potential and most likelihood of restoration being successful.

The intensity of fishing demand at various distances from a given point of fishermen origin is shown by the following tabulation taken from the aforementioned publication entitled The 1965 Survey of Outdoor Recreation Activities.

1/ Not included in the plan.

Percent Distribution by Miles

50 or less	50 to 100	100 to 250	250 to 500	500 or more
37%	27%	28%	7%	1%

The above fisherman-distribution figures show the importance of reestablishing anadromous fisheries within reasonable proximity to the demand or market area. The farther away the fishery from this area, the lower the anticipated demand. If, for example, we wish to satisfy a given demand with resources present in a basin located over 50 miles from the market area, two alternatives are available. We could either meet 37 percent of the demand in the basin of origin or have a corresponding percentage which remains as an unsatisfied demand.

Transfer between Basins

As mentioned in the previous Chapter of this Appendix, "Problems, and Possible Solutions", it is sometimes desirable to transfer demands. These demands could be transferred in some degree to nearby basins where a greater likelihood of achieving successful resource re-establishment is predicted. Based upon the above fisherman-distribution patterns, the proportion of the demand that would travel was transferred. The tables for the plan on sportfish under the anadromous fish habitat class, therefore, depict two steps. (See Tables 0-29 and 0-31). Step one is before demand distribution, while step two shows effects of transferring this demand insofar as seems practicable, to other basins.

RECREATIONAL FISHERIES -- SALT-WATER

Conservation and Development of Existing Resources

On-going Programs -- State and Federal

On-going fishery development programs mainly include providing public access facilities for fishing. Fishery research is also receiving emphasis. Habitat improvement - principally artificial reef construction - is a further example of an on-going program. The effects of on-going programs to provide fishermen access facilities were shown in Table 0-28.

On-going Programs -- Augmented

The effects of augmented programs to conserve and develop existing salt-water resources in order to meet future sport fishing needs were shown in Table 0-29. That table showed the effect of increased access development.

Salt-water sport fishermen require additional facilities in addition to the aforementioned basic access requirements. This activity requires land space adjacent to or extending over fishable marine or estuarine waters in the form of piers, jetties, rock outcrops, bridges, etc. The preferable facility would be the fishing pier, so the quantity of these required was estimated.

Fishing piers would be located at each salt-water fishing access area. Each should have a fishable length of 500 feet or a combination that totals 500 feet. Examples: one fishing pier 10 feet wide for 500 feet or two 250-foot long piers. Because of extreme tidal fluctuations and problems of icing in vicinity of estuaries, fishing piers were not suggested in sub-region A and basin B-6.

The following data were used to compute the design load or fishing capacity (man-days) of a fishing pier (or comparable structure):

184 - Days in Fishing season (May 1 - October 31)

500 - Fishable length (feet)

56 - Number weekend days and holidays

128 - Number of week days

..... - 1 fisherman per 10 feet

..... - Turnover rate (3 fishermen per day)

50 - Fishermen maximum at one time

X3

150 - Fishermen per day (weekends & holidays)

38 - Fishermen per day (weekdays - 25% of weekend)

8,400 - Fisherman-days on weekends (56 X 150)

4,860 - Fisherman-days on weekdays (128 X 38)

13,260 - Total fisherman-days

27 - Fisherman-days per foot of length.

The estimated construction cost for a typical fishing pier -- a wooden deck 10 feet wide, supported by wooden pilings and extending at least 500 feet over water four feet or more in depth -- was $75,000, or approximately $150 per linear foot.

Although fishing-pier footage requirements were suggested, the previously mentioned alternative facilities could possibly serve the same purpose. Jetties could be improved with a hand rail and be smooth-capped to provide better footing. Use and modification of existing facilities, as well as making multiple-purpose use of future facilities, would appear to be less costly than pier construction.

Shore and surf fishing activities require additional land incorporated with the basic parking area. Facility development for this activity can also be used as an alternative to the aforementioned pier fishing-facilities. A proper mix of shore and pier facilities, however, based on demand, would offer the most desirable development. The 1965 National Survey of Fishing and Hunting shows that approximately 32 percent of the salt-water sport fishermen of the Atlantic coast participate in surf fishing. Thus, an ideal mix to meet salt-water sport-fishing needs might be 58 percent of proposed pier requirements and 32 percent of shore and surf fishing requirements. These were the percentages that were utilized to derive the quantity of facilities shown in Tables 0-29 and 0-31.

The land area requirement for surf fishing was estimated, based on the following information. The estimated number of square feet of beach per man-day, 200 times 1,000, represents the size of the unit -- 200,000 square feet, or approximately 4.6 acres. A turnover rate of 2 fishermen per day was used to arrive at 2,300 acres required per 1,000 man-days.

SUMMARY -- PLAN FOR RECREATIONAL FISHERIES

Orientation

To clarify what follows, it is suggested that the reader refer back to Table 0-28. Taking Basin A-1 for example, it will be seen that no needs are indicated for any of the "Type of Use and Resource" categories except "Anadromous". In other words, demands anticipated by the years 1980, 2000, and 2020 can be met by the increased capabilities of all resources anticipated as a result of on-going programs except in the case of anadromous fisheries.

Going now to Table 0-29, it will be seen that the needs for anadromous fisheries have been brought forward from Table 0-28 -- i.e., 39,000 (1980), 45,000 (2000), and 53,000 (2020). What is said in Table 0-29 is that although under on-going programs for anadromous fishes no improvements are anticipated for A-1 within the time frame 1965 through 2020, augmentation of the types of programs now going on so as to make them applicable to A-1 could result in increase capability of the anadromous fisheries resource so as to provide fishing opportunities to the extent of 25,000 man-days by 1980, 29,000 by 2000,

and 34,000 by 2020. Weighed against the total anticipated demand in A-1, this would still leave and unsatisfied demand -- a need -- for 14,000 man-days by 1980, 16,000 by the year 2000, and 19,000 by 2020. It is practicable, however, for these remaining needs to be satisfied through opportunities for angling which exist or will be developed in other nearby basins -- fisheries which are available within the constraints imposed by distances fishermen are willing to go.

As far as the anticipated supply is concerned, there will be, as shown in Table 0-29, no unsatisfied demand for opportunities to fish for anadromous game fishes in Basin A-1. The anticipated adequacy of supply is based upon two elements of the fish and wildlife plan: (1) augmentation of on-going programs for anadromous fisheries restoration so as to develop full resource capability in Basin A-1 within the designated time frame and (2) transfer of the remaining demand to be satisfied by fishing opportunities provided by the anadromous fishery resources of nearby.

The fact that supply is adequate, however, does not mean it is going to be available to the fisherman. Thus, a third element must be introduced into the plan -- provisions for access to the fishery habitat. This element applies both to the use developed within Basin A-1 and that which is considered transferrable to nearby basins, as recognized in Table 0-31. In that Table, figures for Basin A-1 in acres represent the amount of lands which should be acquired in fee simple or permanent easement to provide access to fully take care of the demand for anadromous fishery resources in A-1. It does not appear likely, however, that the supply in A-1 will be capable of supporting more than 25,000 man-days in 1980, 4,000 more by 2000, and 5,000 more by 2020. An adjustment is made, therefore, in the Table headed "Sub-region A, Plan II", bringing the recommended acquisition in Basin A-1 into line with anticipated resource capability and increasing the recommended acquisition in nearby basins to take care of the overflow demand from Basin A-1.

Taking a somewhat more complicated example, such as Basin B-8, and the category "Cold-water Streams", Table 0-29 shows that no augmentation of ongoing programs in included in the plan. There will be deficits in resource capability to meet demands amounting to totals of 351,000 man-days in 1980, 701,000 by the year 2000, and 1,122,000 by 2020.

Table 0-31 Basin 8, under Access Requirements, says that 52 acres of access to cold-water streams should be acquired by 1980, another 52 by 2000, and 62 more by 2020. This would take care of the incremental demand increases. Under Fresh-water Supply Requirements, Table 0-31 for B-8 says that 2,600 acres of polluted cold-water stream habitat needs to be cleaned up by 1980, through abatement at the sources and/or stream flow augmentation. Likewise, water quality should be raised to a satisfactory level in another 2,600 acres of cold-water streams by the year 2000 and in 3,600 more by 2020. These

actions will provide a resource base capable of meeting the incremental increases in needs for cold-water stream-fishing opportunities by 1980, 2000, and 2020. The two actions, (1) acquiring access and (2) improving water quality to improve the capability of cold-water stream fishery resources, for all practical purposes be considered as a single element of the fish and wildlife plan in this example. This relationship holds true for most of the recommended actions.

Fishery elements of the plan defer implementation of selected solutions to meet needs recognized as existing in the base year, 1965, until the year 1980 to allow sufficient time for plans to be acted upon. Highest priority actions -- where needs are most acute -- should be accomplished at the earliest possible date.

Needs which appear in Table 0-31 in parenthesis (or brackets) represent those which it appears impossible to satisfy within a given basin. It may be, however, that they can be satisfied by transfer to other basins (within the limitations of travelling distance), as in the first example given above, where a surplus of fishing opportunity exists. These demands might also be satisfied within the basin where they occur provided fishermen are willing to convert from one fishing category which they may have consistently favored in the past to another which might provide equal enjoyment. Additional solutions are suggested throughout Table 0-31 where appropriate. All were discussed earlier in a general way in the chapter on problems and possible solutions.

In that part of the plan labeled Part II, unsatisfied demands (needs) have been considered met, to the extent possible through out-of-basin transfer in accordance with known fisherman-distribution patterns. Remaining needs were satisfied in most instances by other, additional solutions (as a necessary part of the plan, these cannot be considered "alternative" measures). Needs for recreation related to anadromous fisheries were transferred from basins lacking such resources or potential for development to those in which anadromous fish runs already exist or where there was significant potential for development.

Summary Tables -- Recreational Fisheries Plan

Attachment 0-3 at the end of this Appendix presents a recapitulation of the various elements of the plan for meeting recreational fishery needs, by basin and by Sub-region. These elements are quantified (and their impacts on meeting needs are quantified) in Table 0-31, by basin and by Sub-region, for each of the bench mark years: 1980, 2000, and 2020. For each Sub-region there is a part of Table 0-31, labelled Plan II, which covers the diversion of unsatisfied fishing demand from the basin in which it originates to other basins and Sub-regions where it can be met, to the extent such opportunities are available within known travel limitations. Table 0-32

TABLE 0-32

TOTAL EFFECT OF RECREATIONAL FISHERIES PLAN ON MEETING NEEDS - 1980-2020

(Thousands of man-days)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
A-1	Anadromous 1/	0	0	0	25	29	34	25	29	34	39	45	53	14	16	19
	Anadromous	0	0	0	25	29	34	25	29	34	25	29	34	0	0	0
A-2	Anadromous 1/	31	36	41	25	30	36	56	66	77	56	66	77	0	0	0
	Anadromous	31	36	41	205	240	284	236	276	325	236	276	325	0	0	0
A-3	Anadromous 1/	3	3	3	0	0	0	3	3	3	238	277	323	235	274	320
	Anadromous	3	3	3	0	0	0	3	3	3	153	178	207	150	175	204
A-4	Anadromous 1/	2	2	2	0	0	0	2	2	2	243	281	330	241	279	328
	Anadromous	2	2	2	0	0	0	2	2	2	156	182	215	154	180	213
A-5	Anadromous	224	249	278	63	87	116	287	336	394	287	336	394	0	0	0

1/ Transferring demand between basins.

TABLE O-32 (Continued)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
B-6	Streams															
	Coldwater	71	78	85	5	14	29	76	92	114	76	92	114	0	0	0
	Warmwater	36	39	43	2	7	14	38	46	57	38	46	57	0	0	0
	Lakes															
	Coldwater	1,792	1,971	2,148	92	347	725	1,884	2,318	2,873	1,884	2,318	2,873	0	0	0
	Warmwater	1,685	1,854	2,021	86 2/	325 2/	679 2/	1,771	2,179	2,700	1,771	2,179	2,700	0	0	0
	Total Freshwater	3,584	3,942	4,297	185	693	1,447	3,769	4,635	5,744	3,769	4,635	5,744	0	0	0
	Anadromous	75	93	116	75	92	115	150	185	231	419	515	638	269	330	407
	Anadromous 1/	75	93	116	75	92	115	150	185	231	150	185	231	0	0	0
	Saltwater	938	1,019	1,100	51	198	409	989	1,217	1,509	989	1,217	1,509	0	0	0
B-7	Streams															
	Coldwater	709	709	709	127	335	584	836	1,044	1,293	836	1,044	1,293	0	0	0
	Warmwater	144	161	177	11	32	62	155	193	239	155	193	239	0	0	0
	Lakes															
	Coldwater	606	679	760	44	133	245	650	812	1,005	650	812	1,005	0	0	0
	Warmwater	1,357	1,520	1,672	98	298	578	1,455	1,818	2,250	1,455	1,818	2,250	0	0	0
	Total Freshwater	2,816	3,069	3,318	280	798	1,469	3,096	3,867	4,787	3,096	3,867	4,787	0	0	0
	Anadromous	82	102	126	81	102	126	163	204	252	163	204	252	0	0	0
	Anadromous 1/	82	102	126	574	724	903	656	826 3/	1,029 3/	656	826	1,029	0	0	0
B-8	Streams															
	Coldwater	972	972	972	351	701	1,122	1,323	1,673	2,094	1,323	1,673	2,094	0	0	0
	Warmwater	308	336	363	84	160	257	392	496	620	392	496	620	0	0	0
	Lakes															
	Coldwater	1,079	1,176	1,243	293	559	928	1,372	1,735	2,171	1,372	1,735	2,171	0	0	0
	Warmwater	1,425	1,553	1,677	388	740	1,192	1,813	2,293	2,869	1,813	2,293	2,869	0	0	0
	Total Freshwater	3,784	4,037	4,255	1,116	2,160	3,499	4,900	6,197	7,754	4,900	6,197	7,754	0	0	0
	Anadromous	120	124	140	0	3	18	120	127	158	100	127	158	0	0	0
	Anadromous 1/	120	124	140	324	320	373	444	444	513	288	381	513	0	0	0
B-9	Streams															
	Coldwater	620	620	620	108	279	481	728	899	1,101	728	899	1,101	0	0	0
	Warmwater	43	46	49	5	14	24	48	60	73	48	60	73	0	0	0
	Lakes															
	Coldwater	1,283	1,283	1,283	221	577	992	1,504	1,860	2,275	1,504	1,860	2,275	0	0	0
	Warmwater	2,325	2,511	2,687	247	668	1,203	2,572	3,179	3,890	2,572	3,179	3,890	0	0	0
	Total Freshwater	4,271	4,460	4,639	581	1,538	2,700	4,852	5,998	7,339	4,852	5,998	7,339	0	0	0
	Anadromous	48	54	61	22	27	33	70	81	94	469	582	712	399	501	613
	Anadromous 1/	48	54	61	22	27	33	70	81	94	70	81	94	0	0	0
	Saltwater	5,986	6,067	6,148	911	2,462	4,286	6,897	8,529	10,434	6,897	8,529	10,434	0	0	0
B-10	Streams															
	Coldwater	923	923	923	126	423	423	1,049	1,346	1,346	1,049	1,346	1,702	0	0	356
	Coldwater 4/	923	923	923	126	423	423	1,049	1,346	1,346	1,049	1,346	1,346	0	0	0
	Warmwater	147	147	147	20	67	124	167	214	271	167	214	271	0	0	0
	Lakes															
	Coldwater	566	565	566	78	260	478	644	826	1,044	644	826	1,044	0	0	0
	Coldwater	566	566	566	78	260	834	644	826	1,400	644	826	1,400	0	0	0
	Warmwater	517	595	672	7	78	179	524	673	851	524	673	851	0	0	0
	Total Freshwater	2,153	2,231	2,308	231	828	1,204	2,384	3,059	3,512	2,384	3,059	3,868	0	0	356
	Total Freshwater 4/	2,153	2,231	2,308	231	828	1,551	2,384	3,059	3,868	2,384	3,059	3,868	0	0	0
	Anadromous	40	43	47	8	11	14	48	54	61	203	261	330	155	207	269
	Anadromous 1/	40	43	47	8	11	14	48	54	61	48	54	61	0	0	0
	Saltwater	1,597	1,678	1,759	148	561	1,073	1,745	2,239	2,832	1,745	2,239	2,832	0	0	0

1/ Transferring demands between basins.
2/ Convert to combination coldwater lakes.
3/ Includes stocking.
4/ Unsatisfied demand convert to coldwater ponds.

TABLE 0-32 (Continued)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
C-11	Streams															
	Coldwater	683	744	796	27	70	157	710	814	953	710	814	953	0	0	0
	Warmwater	645	703	759	23	63	138	668	765	897	668	766	897	0	0	0
	Lakes															
	Coldwater	645	703	759	23	63	138	668	766	897	668	766	897	0	0	0
	Warmwater	2,047	2,231	2,409	83	211	451	2,130	2,442	2,860	2,130	2,442	2,860	0	0	0
	Total Freshwater	4,020	4,381	4,723	156	407	1,884	4,176	4,788	5,607	4,176	4,788	5,607	0	0	0
C-12	Streams															
	Coldwater	430	490	549	0	16	61	430	506	610	417	506	610	0	0	0
	Coldwater 1/	430	490	549	0	33	112	430	523	631	417	523	661	0	0	0
	Warmwater	404	461	516	0	15	58	404	476	574	393	476	574	0	0	0
	Warmwater 1/	404	461	516	0	15	71	404	476	590	393	476	590	0	0	0
	Lakes															
	Coldwater	404	461	516	0	15	58	404	476	574	393	476	574	0	0	0
	Coldwater 1/	404	461	516	2	45	120	406	506	636	406	506	636	0	0	0
	Warmwater	1,288	1,468	1,644	0	50	136	1,288	1,518	1,830	1,252	1,518	1,830	0	0	0
	Total Freshwater	2,526	2,880	3,225	0	96	363	2,526	2,976	3,588	2,455	2,976	3,588	0	0	0
	Total Freshwater 1/	2,526	2,880	3,225	2	143	492	2,528	3,023	3,717	2,468	3,023	3,717	0	0	0
	Anadromous	215	241	278	53	87	121	273	331	399	273	331	399	0	0	0
	Anadromous 1/	215	244	278	155	206	266	370	450	544	370	450	544	0	0	0
C-13	Streams															
	Coldwater	349	377	377	0	0	0	349	377	377	345	419	503	0	42	126
	Coldwater 1/	349	377	377	0	0	0	349	377	377	345	402	452	0	25 2/	75 2/
	Warmwater	328	384	407	0	10	0	328	394	407	325	394	473	0	0	66
	Warmwater 1/	328	384	407	0	10	0	328	394	407	325	394	447	0	0	40 2/
	Lakes															
	Coldwater	293	293	293	0	0	0	293	293	293	325	394	473	32	101	180
	Coldwater 1/	293	293	293	0	0	0	293	293	293	312	353	400	19 2/	60 2/	107 2/
	Warmwater	918	918	918	118	338	590	1,036	1,256	1,508	1,036	1,256	1,508	0	0	0
	Total Freshwater	1,888	1,972	1,995	118	348	590	2,006	2,320	2,585	2,031	2,463	2,957	25	143	373
	Total Freshwater 1/	1,888	1,972	1,995	118	348	590	2,006	2,320	2,585	2,018	2,405	2,807	12 2/	85 2/	222 2/
	Anadromous	5	5	5	0	0	0	5	5	5	102	124	149	97	119	144
	Anadromous 1/	5	5	5	0	0	0	5	5	5	5	5	5	0	0	0
	Saltwater	13,368	13,449	13,530	1,879	5,038	8,671	15,247	18,487	22,201	15,247	18,487	22,201	0	0	0

1/ Transferring demand between basins.
2/ Needs may be satisfied by greatly increased fishstocking, fish for fun, lowered satisfaction level etc.

TABLE 0-32 (Continued)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
D-14	Streams															
	Coldwater	901	901	901	93	303	545	994	1,204	1,446	994	1,204	1,446	0	0	0
	Warmwater	94	109	124	0	0	2	94	109	126	86	105	126	0	0	0
	Lakes															
	Coldwater	502	582	650	0	20	73	502	602	723	497	602	723	0	0	0
	Warmwater	561	561	561	1	120	256	562	681	817	562	681	817	0	0	0
	Total Freshwater	2,058	2,153	2,236	94	443	876	2,152	2,596	3,112	2,139	2,592	3,112	0	0	0
	Anadromous	6	7	9	6	7	8	12	14	17	12	14	17	0	0	0
D-15	Streams															
	Coldwater	1,988	2,068	2,130	356	888	1,560	2,344	2,956	3,690	2,344	2,956	3,690	0	0	0
	Warmwater	994	1,034	1,075	178	444	770	1,172	1,478	1,845	1,172	1,478	1,845	0	0	0
	Lakes															
	Coldwater	1,408	1,464	1,523	252	630	1,090	1,660	2,094	2,613	1,660	2,094	2,613	0	0	0
	Warmwater	3,975	4,134	4,299	713	1,777	3,080	4,688	5,911	7,379	4,688	5,911	7,379	0	0	0
	Total Freshwater	8,365	8,700	9,027	1,499	3,739	6,500	9,864	12,439	15,527	9,864	12,439	15,527	0	0	0
	Anadromous	387	443	510	41	97	164	428	540	674	428	540	674	0	0	0
	Saltwater	718	799	880	63	186	349	781	985	1,229	781	985	1,229	0	0	0
D-16	Streams															
	Coldwater	45	73	73	0	0	0	45	73	73	28	35	43	0	0	0
	Warmwater	61	99	99	0	0	0	61	99	99	38	48	59	0	0	0
	Lakes															
	Coldwater	83	83	83	7	30	56	90	113	139	90	113	139	0	0	0
	Warmwater	188	188	188	10	59	117	198	247	305	198	247	305	0	0	0
	Total Freshwater	377	443	443	17	89	173	394	532	616	354	443	546	0	0	0
	Anadromous	8	9	10	1	2	3	9	11	13	9	11	13	0	0	0
	Saltwater	7,068	7,149	7,230	909	2,822	5,094	7,977	9,971	12,324	7,977	9,971	12,324	0	0	0

TABLE 0-32 (Continued)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
E-17	Streams															
	Coldwater	3,196	3,324	3,457	479	1,267	2,246	3,675	4,591	5,703	3,675	4,591	5,703	0	0	0
	Warmwater	959	997	1,037	143	380	674	1,102	1,377	1,711	1,102	1,377	1,711	0	0	0
	Warmwater 1/	959	997	1,037	143	452	933	1,102	1,449	1,970	1,102	1,449	1,970	0	0	0
	Lakes															
	Coldwater	639	665	692	96	253	449	735	918	1,141	735	918	1,141	0	0	0
	Warmwater	3,196	3,324	3,457	479	1,267	2,246	3,675	4,591	5,703	3,675	4,591	5,703	0	0	0
	Total Freshwater	7,990	8,310	8,643	1,197	3,167	5,615	9,187	11,477	14,258	9,187	11,477	14,258	0	0	0
	Total Freshwater 1/	7,990	8,310	8,643	1,197	3,239	5,874	9,187	11,549	14,517	9,187	11,549	14,517	0	0	0
	Anadromous	250	307	377	210	267	336	460	574	713	460	574	713	0	0	0
E-18	Streams															
	Warmwater	1,444	1,444	1,444	189	400	400	1,633	1,844	1,844	1,633	2,025	2,492	0	181	648
	Warmwater 1/	1,444	1,444	1,444	189	400	400	1,633	1,844	1,844	1,633	1,844	1,844	0	0	0
	Lakes															
	Warmwater	737	737	737	1,614	2,178	2,849	2,351	2,915	3,586	2,351	2,915	3,586	0	0	0
	Warmwater 2/	737	737	737	1,614	2,287	3,238	2,351	3,024	3,975	2,351	3,024	3,975	0	0	0
	Total Freshwater	2,181	2,181	2,181	1,803	2,578	3,249	3,984	4,759	5,430	3,984	4,940	6,078	0	181	648
	Total Freshwater 1/	2,181	2,181	2,181	1,803	2,687	3,638	3,984	4,868	5,819	3,984	4,868	5,819	0	0	0
	Anadromous	270	361	451	0	0	0	226	361	451	226	281	345	0	0	0
	Saltwater	2,471	2,552	2,633	246	816	1,511	2,717	3,368	4,144	2,717	3,368	4,144	0	0	0

1/ Transferring demand between basins.
2/ Includes 60% of unsatisfied demands for warmwater streams converted to warmwater ponds.

TABLE 0-32 (Continued)

Basin	Type of Use and Resource	Total Use Capability with On-Going Programs 1980	2000	2020	Gain in Use Capability from Augmented Programs 1980	2000	2020	Total Use Capability of Fishery Resources 1980	2000	2020	Total Demand Anticipated 1980	2000	2020	Remaining Needs not Met by Conservation & Development 1980	2000	2020
F-19	Streams															
	Coldwater	29	29	29	305 [2]	446 [2]	616 [2]	334	475	645	359	515	705	25	40	60
	Warmwater	1,651	1,651	1,651	446 [3]	1,353 [3]	2,183 [3]	2,097	3,004	3,834	2,097	3,004	4,111	0	0	277
	Warmwater [1]	1,651	1,651	1,651	446	1,353	2,183	2,097	3,004	3,834	2,097	3,004	3,834	0	0	0
	Lakes															
	Warmwater	947	947	947	2,587	4,117	5,984	3,534	5,064	6,931	3,534	5,064	6,931	0	0	0
	Warmwater [1]	947	947	947	2,587	4,117	6,233	3,534	5,064	7,180	3,534	5,064	7,180	0	0	0
	Total Freshwater	2,627	2,627	2,627	3,338	5,916	8,783	5,965	8,543	11,410	5,990	8,583	11,747	25	40	337
	Total Freshwater [1]	2,627	2,627	2,627	3,338	5,916	9,032	5,965	8,543	11,659	5,990	8,583	11,719	25	40	60
	Anadromous	243	341	460	208	306	424	451	647	884	451	646	884	0	0	0
	Saltwater	2,447	2,528	2,609	590	1,825 [4]	3,347 [4]	3,037	4,353	5,956	3,037	4,353	5,956	0	0	0
F-20	Streams															
	Coldwater	3	3	3	5	7	10	8	10	13	8	10	13	0	0	0
	Warmwater	170	170	170	6	6	6	176	176	176	308	402	514	132	226	338
	Warmwater [1]	170	170	170	6	6	6	176	176	176	176	176	176	0	0	0
	Lakes															
	Warmwater	557	629	629	0	0	130	557	629	759	455	594	759	0	0	0
	Warmwater [1]	557	629	629	30	191	468	587	820	1,097	587	820	1,097	0	0	0
	Total Freshwater	730	802	802	11	13	146	741	815	948	771	1,006	1,286	30	191	338
	Total Freshwater [1]	730	802	802	41	204	484	771	1,006	1,286	771	1,006	1,286	0	0	0
	Anadromous	202	227	262	0	25	60	202	252	322	193	252	322	0	0	0
	Saltwater	294	375	456	0	0	0	294	375	456	269	351	448	0	0	0
F-21	Streams															
	Coldwater	21	21	21	82 [2]	103 [2]	128 [2]	103	124	149	132	167	209	29	43	60
	Warmwater	642	642	642	56	56	56	698	698	698	771	974	1,220	73	276	522
	Warmwater [1]	642	642	642	56	56	56	698	698	698	727	852	1,072	29	154	374
	Lakes															
	Warmwater	1,017	1,017	1,017	282	626	1,039	1,299	1,643	2,056	1,299	1,643	2,056	0	0	0
	Warmwater [1]	1,017	1,017	1,017	326	748	1,187	1,343	1,765	2,204	1,343	1,765	2,204	0	0	0
	Total Freshwater	1,680	1,680	1,680	420	785	1,223	2,100	2,465	2,903	2,202	2,784	3,485	102	319	582
	Total Freshwater [1]	1,680	1,680	1,680	464	907	1,371	2,144	2,587	3,051	2,202	2,784	3,485	58	197	434
	Anadromous	346	444	531	206	253 [3]	340 [3]	552	697	871	552	697	871	0	0	0
	Saltwater	1,900	1,981	2,062	376 [4]	894 [4]	1,537 [3]	2,276	2,875	3,599	2,276	2,875	3,599	0	0	0

1/ Converted from warmwater streams.
2/ Provided greatly increased trout stocking rates to supply demand.
3/ Reduced satisfaction level.
4/ Pollution abatement.

brings into focus the impact of all elements of the plan for sport fisheries conservation and development, defining the extent to which unsatisfied demand (needs) will remain.

COMMERCIAL FISHERIES

Conservation and Development of Existing Resources

On-going Programs - State and Federal

Many of the on-going fishery programs are directed toward increasing or maintaining the potentials of marine resources to produce food and industrial products. These programs include biological research to obtain essential information on commercially important species of animals and plants, economic studies to develop data which will be of assistance to commercial fishermen, and experimental and exploratory work to develop and test new gear and find new sources of supply. The National Marine Fisheries Service, part of the National Oceanic and Atmospheric Administration, makes available to the fishing industry a grading and inspection program whereby the fisherman, if he so desires, can monitor the quality of his fish and fish products, thus improving public acceptance and tending to increase the use of these items. Toward this end also, a staff of marketing specialists and home economists is maintained to provide services which will help to stimulate demand. A fish protein concentrate (FPC) has been developed, providing the means of supplementing the protein-deficient diets which plague people in many parts of the world as well as making use of fish species which are abundant but not popular as items to be bought at the market. Other programs have been established to assist the fishing industry to modernize and in other ways improve the efficiency of the fishing fleet.

State programs having to do with commercial fisheries vary widely from state to state, as might be expected from the variety of conditions and fishery resources along the Atlantic Coast from Maine to North Carolina. The general objectives, however, are much the same as those of the Federal programs, namely, conserve and develop the resources and to aid the industry in both the harvesting and marketing of its products.

It is estimated that these on-going programs, assuming that they are continued at their present levels of scope and funding, will enable the present capability of the estuarine-dependent commercial resources for meeting human needs to be maintained during the period from now until the year 2020. In other words, if trends in recent years are valid criteria, the on-going programs of Federal and State governments will be doing well to hold the line against the many competing and otherwise adverse factors. A quantification of the supply capability referred to will be found in Table 0-33 (these figures also appeared earlier in this appendix in Table 0-18). It is

TABLE 0-33
ESTUARINE-DEPENDENT COMMERCIAL FISHERY RESOURCE CAPABILITY
(Thousands of pounds)

Sub-Region	Type of Resource	Average Annual Sustained Harvest Capability: Potential Under On-going Programs	Average Annual Sustained Harvest Capability: Potential With Augmented Programs
A	Edible Finfish	380	8,787
	Indus. Finfish	4,659	14,773
	Shellfish	6,098	12,336
	Seaworms	2,264	4,762
B	Edible Finfish	21,117	28,762
	Indus. Finfish	10,971	39,324
	Shellfish	11,482	59,520
	Seaworms	114	240
C	Edible Finfish	18,404	54,199
	Indus. Finfish	45,246	289,160
	Shellfish	15,068	39,258
D	Edible Finfish	26,070	81,408
	Indus. Finfish	181,340	847,222
	Shellfish	9,396	48,233
E&F	Edible Finfish	103,230	105,000
	Indus. Finfish	240,000	240,000
	Shellfish	105,000	107,000
TOTAL NAR	Edible Finfish	169,201	278,156
	Industrial Finfish	482,216	1,430,479
	Shellfish	147,044	266,347
	Seaworms	2,378	5,002

considered that, stated very simply, the productivity of the estuarine environment at this time reflects present conditions of water quality control, other management aspects, and existing law and policy regarding their use, although perhaps it would be more accurate to say the laws and policies which have prevailed until very recent times.

On-going Programs - Augmented

There is nothing wrong with the on-going programs of today or with many of the new laws now on the books or those which give promise of being passed in the near future. The real shortcomings have to do with magnitude and scope and comprehensiveness. They do not represent all that should be done but taken as a whole, they are attacking a great many of the high priority problems. These problems are of sufficient importance to mankind -- to the people of the United States -- that they warrant receiving a much greater investment of public funds than has been the case in the past.

The development potential of the estuarine-dependent commercial fishery resources under adequate augmentation of on-going programs was estimated with reference to maximum historical catch records, using these as indicators of the supply potential. Yearly harvest records of certain important commercial species were used as indices. Index species were compared to the total present harvest by a proportion and from this, development capabilities were derived and future supply capability projected. The results are shown in Table 0-33.

Under an augmented on-going program, it will be possible to meet the needs which otherwise would be expected in Sub-regions A through D by the year 2000 and thereafter, except for edible finfish needed in Sub-region B. Sub-regions E and F would still have large needs for edible finfish and shellfish, in spite of the accomplishments anticipated from the augmented programs, it is believed that industrial finfish and seaworm resources could be brought to a level at which they would be capable of meeting all needs through the year 2020.

Other Measures for Meeting Commercial Fishery Needs

Additional measures will be required in order to satisfy the remaining needs for finfish and shellfish. Many possibilities are available to provide for these needs. More intensive management practices could be adopted to provide for the shellfish needs. Increased use could be made of presently under-utilized shellfish species such as the blue mussel and conch. Importation of shellfish from areas outside of the NAR is another possibility.

To provide for the needs for edible finfish, many solutions are also available. Aquaculture and mariculture may offer solutions

as they may increase production in the near future for several commercial species such as shrimp. There are several major problems with these solutions, however, in bringing new skills into the Region and in overcoming a number of technological, legal and economic problems. Because anadromous fish represent a portion of this resource, the development potential of the anadromous fishery should be realized to assist in meeting the needs. Conversion of surplus industrial and so-called "trash" fish species to edible FPC products offers an additional possibility. Increased use of edible offshore species and importation of fish are other possibilities. Better management of existing stocks and improved knowledge and understanding of problems will be necessary if increased supplies are to be realized.

WILDLIFE

General Discussion

Planning Concepts

In wildlife management programs, the environmental factors limiting wildlife populations should be controlled to the extent possible. Some of these by their very nature, however, cannot be controlled. These include such items as the natural tendency of some species to have recurring population cycles and the possible occurrence of bad weather during critical periods such as nesting seasons. Other factors such as food supply, habitat destruction, and disease are controllable, and increased management efforts should be directed towards them. Management should develop a harmonious balance within the various controllable factors, in order to provide the habitat quality and quantity essential to wildlife populations.

The three game classes - big game, small game, and waterfowl - are composed of smaller groupings. These groupings, for example, in the category of small game are forest game and farm game. These groupings are also capable of being sub-divided into individual species. Because of the broad reconnaissance nature of this study, however, hunting needs were only estimated for the three game classes. This factor tends to mask needs for the game class subdivisions. This is particularly relative to farm-game habitat where future declines are predicted, thus causing correspondingly large needs to occur. Also, needs for individual species may exist even where no needs are shown for the larger categories of the game classes.

To provide adequate opportunities for future recreational use of the wildlife resources in the NAR, it is essential that conservation and development programs for the resources and their associated habitats be continued (initiated where lacking) and augmented. The full realization of wildlife potentials and assurance

of future continued use of these resources are dependent upon preservation and development of adequate habitat, access to the resources, and management of the resources through harvest.

The degree to which these practices should be implemented in the NAR will, of course, vary with the projection year, wildlife category, and location. The individual basins and sub-regions in the NAR have specific problems which require intensive habitat management and/or needs for additional habitat. Other areas should receive more for small-game stocking and require additional access. It must be remembered, however, that the projected plans for management of wildlife resources in the NAR must include the full complement of conservation practices indicated. If developed without consideration for all recommended practices, it will not be possible to accomplish the desired conservation and future use of the wildlife resources.

Wildlife Habitat

The pernicious conditions affecting the wildlife populations of the NAR are the universal ones of steadily declining habitat quality and quantity. This is further complicated by a steadily increasing demand for the use of these resources. The use of land for homes, highways, airports, industry, and more intensified agriculture is reducing the amount of habitat available to most forms of wildlife. Unless coordinated efforts are initiated to curtail the loss of valuable wildlife habitat, this trend will continue at an accelerated rate. Everything man does to modify his environment affects the environment of other living things. Reduced habitat quality will eventually produce reductions in habitat quantity. Wildlife suffer the consequences from intensive land use, water and air pollution, harassment, and other factors associated with a rapidly increasing human population.

Examples of man's use of the environment in relation to the subsequent effect on wildlife can be demonstrated in all areas of the NAR. Where urban and industrial development occurs on flood plain margins, the ruffed grouse habitat is virtually eliminated. Reservoir development in the vicinity of critical deer wintering areas may remove vitally needed habitat. Water and land development which encroaches on waterfowl breeding, resting, or wintering areas effectively reduces waterfowl populations to a dangerously low level. Upland game populations are reduced whenever a new highway or road is constructed through productive habitat. Also, the use of herbicide sprays to control weeds and brush along these roads destroys protective cover.

Human demands for use of wildlife resources cannot be satisfied unless adequate wildlife populations are available. To maintain these wildlife populations involves the conservation and development of their habitat. The conservation and development of existing habitat is the most important element in our plan to meet future needs related to wildlife resources.

It is recognized that in some locations habitat losses are inevitable; to a certain extent such losses can be offset by habitat management programs. Such programs should be designed to increase both the quality of the remaining habitat and possibly provide increased habitat quantities for other species.

Habitat quality is a result of the relationship between available food, cover, and water. That determines the total productivity of the habitat. Wildlife populations decrease due to poor-quality habitat when food, cover, and water are not present in the proper physical relationship. Habitat quality can be controlled and improved by planting food and cover, augmenting water supplies, protecting the habitat, using proper agricultural practices, acquiring additional lands, and educating landowners as to the value of maintaining wildlife habitat quality.

Access

The majority of the recreational use of wildlife resources in the NAR occurs on private lands. Although the private landowner has no greater claim to the ownership of wildlife than anyone else, he frequently restricts access to his property and thus controls the use of the resources. This leads to crowding of hunting areas, vandalism, trespassing, and access fees, all of which inhibit the recreational opportunities related to wildlife resources.

The word opportunity can best be described in terms of the availability of lands or waters upon which recreational use occurs. Generally, opportunity also implies the availability of the wildlife resources and regulations governing the use of the resources. These latter implications are equally important in the full development of the resources, but it benefits the user little if he is denied access to lands and waters abounding in wildlife.

Future development programs should insure that the public is afforded full opportunity to utilize the wildlife resources of the NAR. Reductions in posted lands, opening new areas through the development of roads and/or trails, and maintaining existing accessible areas should be primary objectives of future efforts to provide access.

Wildlife Management

Plans for the recreational use of wildlife resources should also include plans for managing these resources. Continued emphasis on wildlife management is essential in the development of future programs related to use of wildlife resources.

The most effective management tools available for maintaining wildlife populations at desired levels are regulation of hunting seasons, bag limits, and areas of use. By implementing these controls,

it is possible to have an annual harvest which will maintain the resource in balance with its habitat and provide for the continued use of the resource. The wise use of these regulatory powers, however, must include both knowledge of the population, dynamics of the resource and population levels. For example, if Sunday hunting were initiated as an aid to satisfaction of hunting demands, it would obviously provide additional recreational opportunities. It might even relieve pressure in other areas receiving extremely high use. If the resource in question, however, is currently being utilized at the maximum allowable rate, then introduction of additional pressure though allowing Sunday hunting would be detrimental.

Another management tool of particular importance in the NAR is small-game stocking. This is done with the thought of supplementing native wildlife populations and assisting in meeting both present and projected demands upon the resource. The extensive areas of marginal farm-game habitat in the NAR appear to offer considerable opportunity for continuing this practice during future years. The natural productive capacity of such habitat cannot be expected to provide supplies in quantities sufficient for satisfaction of demands upon the small-game resources of the NAR.

The essential ingredients to the success of any wildlife management program is full knowledge of the resource requirements. This is required to support maximum numbers of the managed species which are required to provide maximum recreational use. This can only be achieved through the development of more efficient methods for measuring resource populations and their related habitats.

Waterfowl

Waterfowl habitat requirements in the NAR have been considered first and foremost for the perpetuation of the resources, and secondarily in relation to satisfaction of demands related to use of the resources.

The preservation of existing habitat is considered essential as a means of maintaining continental waterfowl populations for posterity and providing sufficient opportunities for use of the resources. The preservation of the existing habitat coupled with provisions for additional access and appropriate hunting regulations will adequately serve the demands for the use of waterfowl resources in the NAR. It is recognized that the development of additional habitat would most assuredly benefit both local and Atlantic Flyway populations and should be included whenever possible. To ascertain the exact extent and location of additional waterfowl habitat areas, however, is considered beyond the scope of this report.

Conservation and Development of Existing Resources

On-going Programs - State and Federal

On-going Federal and State programs include planting game food, posting boundaries, fencing, building roads and trails, clearing, controlling noxious vegetation, managing hunts, and trapping and restocking game to suitable ranges. A substantial portion of on-going programs is devoted to projects that benefit waterfowl.

The increasing need for public ownership of lands for wildlife management and public hunting is reflected in acquisition programs. Legal "access" routes have been acquired and developed to public lands that are otherwise unavailable because of physical or trespass barriers or are available only to a limited extent.

Wildlife research, which includes surveys, investigations, and basic studies, is also conducted. Research activities are primarily directed toward assisting and improving management efforts to meet responsibilities for the resources.

It is anticipated that the effects of the foregoing federal and state conservation and development programs will enable the optimum resource capability to be realized. The capability of these resources was shown on Table 0-11.

On-going Programs - Augmented

Introduction. Although on-going programs are providing access, additional access is required. This is because a large percentage of the available wildlife habitat is in private ownership and, therefore, subject to additional limitations related to both trespass and local zoning laws. These factors tend to limit public use of the land and its related wildlife resources. Without access no amount of habitat quantity or quality will provide adequate hunting opportunities.

In addition to access, hunting regulations should be developed to the extent that they provide the opportunity for maximum sustained yield of the resources. To achieve this, continual surveillance of resource habitat fluctuations should be practiced. In addition, research should continue toward the development of more efficient methods for measuring resource populations and their related habitats.

The needs that are shown in Table 0-11 represent the needs that can only be satisfied by augmenting existing on-going programs. The devices to provide for these demands are shown on Table 0-34. These devices, as previously stated, include additional access, legislation and management.

TABLE 0-34

HUNTING ACCESS AND HABITAT MANAGEMENT REQUIREMENTS

(Figures in thousands/Access requirements represent incremental increases)

SUB-REGION A

		1980				2000				2020			
Basin	Wildlife Category	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other
A-1	Big Game	0	0	(5)	(3)	0	0	(5)	(3)	0	0	(5)	(3)
	Small Game	0	0	(5)	(3)(4)(3)	17	.1 sq.mi.	(4)	(3)(4)(2)	71	.2 sq.mi.	(4)	(3)(4)(2)
	Waterfowl	7	.1 acres	(4)	(3)	9	.1 acres	(3)	(2)	12	.2 acres	(3)	(2)
A-2	Big Game	0	0	(5)	(2)	30	.25 sq.mi.	(4)	(2)	96	.1 sq.mi.	(3)	(2)
	Small Game	27	0	(2)	(1)(4)(3)	98	.1 sq.mi.	(2)	(1)(4)(2)	207	.1 "	(2)	(1)(4)(2)
	Waterfowl	0	0	(4)	(4)	0	0	(3)	(3)	4	0	(3)	(3)
A-3	Big Game	0	0	(4)	(2)	25	.2 sq.mi.	(4)	(2)	63	.2 sq.mi.	(4)	(1)
	Small Game	57	.2 sq.mi.	(3)	(1)(4)(2)	113	0	(3)	(1)(4)(2)	170	0	(3)	(1)(4)(2)
	Waterfowl	6	5.4 acres	(3)	(2)	10	3.8 acres	(3)	(2)	14	0	(3)	(2)
A-4	Big Game	0	0	(4)	(2)	0	0	(4)	(2)	12	.05 sq.mi.	(4)	(2)
	Small Game	24	.05 sq.mi.	(4)	(2)(4)(2)	84	.1 sq.mi.	(4)	(2)(4)(2)	133	.1 "	(4)	(2)(4)(2)
	Waterfowl	8	.8 acres	(3)	(2)	10	.6 acres	(3)	(2)	14	0	(3)	(2)
A-5	Big Game	0	0	(4)	(2)	33	.15 sq.mi.	(4)	(2)	74	.2 sq.mi.	(4)	(2)
	Small Game	0	0	(3)	(2)(4)(2)	0	0	(3)	(2)(4)(2)	0	0	(3)	(2)(4)(2)
	Waterfowl	0	0	(3)	(2)	0	0	(3)	(2)	4	13.0 acres	(3)	(2)
Sub-	Big Game	0	0	(4)	(2)	0	0	(4)	(2)	200	.5 sq.mi.	(4)	(2)
Region	Small Game	0	0	(3)	(2)(4)(2)	202	.2 sq.mi.	(3)	(2)(4)(2)	540	.3 "	(3)	(2)(4)(2)
A	Waterfowl	7	7.0 acres	(3)	(2)	26	4.0 acres	(3)	(2)	42	13.0 acres	(3)	(2)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as *indicated by land use projection estimates*) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance. Same ranking as 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance, and (5) insignificant.

Table 0-34 (Continued) SUB-REGION B

Basin	Wildlife Category	1980 Man-Day 1/ Needs	1980 Access Needs	1980 Habitat 2/ MGMT	1980 MGMT 3/ Other	2000 Man-Day 1/ Needs	2000 Access Needs	2000 Habitat 2/ MGMT	2000 MGMT 3/ Other	2020 Man-Day 1/ Needs	2020 Access Needs	2020 Habitat 2/ MGMT	2020 MGMT. 3/ Other
B-6	Big Game	54	.1 sq.mi.	(1)	(2)	153	.2 sq.mi.	(1)	(2)	279	.05 sq.mi.	(1)	(2)
	Small Game	2	0	(3)	(2)(4)(2)	206	.25 "	(3)	(2)(4)(2)	435	.4 "	(3)	(2)(4)(2)
	Waterfowl	0	0	(3)	(3)	7	0	(3)	(3)	25	4.5 acres	(3)	(3)
B-7	Big Game	56	.2 sq.mi.	(1)	(1)	165	.4 sq.mi.	(1)	(1)	294	0	(1)	(1)
	Small Game	63	0	(3)	(2)(4)(3)	259	.05 "	(3)	(2)(4)(2)	464	.05 sq.mi.	(3)	(2)(4)(2)
	Waterfowl	19	1.3 acres	(3)	(3)	35	2.4 acres	(3)	(3)	52	2.8 acres	(3)	(3)
B-8	Big Game	135	.3 sq.mi.	(4)	(2)	295	.3 sq.mi.	(4)	(2)	489	.4 sq.mi.	(4)	(2)
	Small Game	245	.7 "	(3)	(2)(4)(3)	627	.3 "	(3)	(2)(4)(3)	1,035	.35 sq.mi.	(3)	(2)(4)(3)
	Waterfowl	54	9.7 acres	(2)	(3)	81	2.0 acres	(2)	(3)	110	0	(2)	(3)
B-9	Big Game	1	0	(4)	(3)	15	.1 sq.mi.	(4)	(3)	32	.1 sq.mi.	(4)	(3)
	Small Game	256	.5 sq.mi.	(3)	(1)(3)(2)	681	.4 "	(2)	(1)(3)(2)	1,304	.1 "	(2)	(1)(3)(2)
	Waterfowl	32	0	(2)	(3)	85	1.3 acres	(2)	(3)	149	2.2 acres	(2)	(3)
B-10	Big Game	0	0	(4)	(3)	0	0	(4)	(3)	0	0	(4)	(3)
	Small Game	97	.2 sq.mi.	(3)	(2)(3)(2)	394	.65 sq.mi.	(3)	(2)(3)(2)	691	.45 sq.mi.	(3)	(2)(3)(2)
	Waterfowl	17	0	(2)	(2)	34	0	(2)	(2)	51	0	(2)	(2)
Sub-	Big Game	230	.6 sq.mi.	(3)	(2)	619	1.0 sq.mi.	(3)	(2)	1,093	.6 sq.mi.	(3)	(2)
Region	Small Game	663	1.4 "	(2)	(2)(3)(2)	2,167	1.7 "	(2)	(2)(3)(2)	3,929	1.4 "	(2)	(2)(3)(2)
B	Waterfowl	114	11.0 acres	(2)	(3)	242	6.0 acres	(2)	(3)	387	10.0 acres	(2)	(3)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates), is converted to man-days and is less than total demand estimations.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance as listed in 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species, and application of sustained yield harvest of resources. Each in turn rated from 1-5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance, and (5) insignificant.

Table 0-34 (Continued) SUB-REGION C

		1980				2000				2020			
Basin	Wildlife Category	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other
C-11	Big Game	0	0	(3)	(3)	0	0	(3)	(3)	0	0	(3)	(3)
	Small Game	0	0	(2)	(2)(5)(2)	217	.9 sq.mi.	(2)	(1)(5)(1)	642	.8 sq.mi.	(2)	(1)(5)(1)
	Waterfowl	10	0	(2)	(2)	17	0	(2)	(2)	26	0	(2)	(2)
C-12	Big Game	0	0	(4)	(3)	0	0	(4)	(3)	0	0	(4)	(3)
	Small Game	10	.4 sq.mi.	(1)	(1)(4)(1)	152	.8 sq.mi.	(1)	(1)(4)(1)	414	.9 sq.mi.	(1)	(1)(4)(1)
	Waterfowl	57	1.9 acres	(2)	(2)	81	.5 acres	(2)	(2)	106	1.0 acres	(2)	(2)
C-13	Big Game	0	0	(3)	(2)	0	0	(3)	(2)	0	0	(3)	(2)
	Small Game	149	.1 sq.mi.	(2)	(1)(4)(2)	419	.1 sq.mi.	(1)	(1)(4)(2)	706	.1 sq.mi.	(1)	(1)(4)(2)
	Waterfowl	72	9.0 acres	(1)	(2)	121	7.0 acres	(1)	(2)	166	7.0 acres	(1)	(2)
Sub-Region C	Big Game	0	0	(3)	(3)	0	0	(3)	(3)	0	0	(3)	(3)
	Small Game	0	0	(2)	(1)(4)(2)	788	1.8 sq.mi.	(1)	(1)(4)(2)	1,762	1.8 sq.mi.	(1)	(1)(4)(2)
	Waterfowl	139	10.9 acres	(2)	(2)	219	7.5 acres	(2)	(2)	298	8.0 acres	(2)	(2)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance. Same ranking as 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance, and (5) insignificant.

Table 0-34 (Continued) SUB-REGION D

		1980				2000				2020			
Basin	Wildlife Category	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other
D-14	Big Game	179	.1 sq.mi.	(2)	(2)	289	.1 sq.mi.	(1)	(1)	430	.1 sq.mi.	(1)	(1)
	Small Game	316	.1 "	(3)	(1)(4)(2)	712	.15 "	(1)	(1)(4)(1)	1,164	.2 "	(1)	(1)(4)(1)
	Waterfowl	45	3.3 acres	(1)	(1)	66	1.9 acres	(1)	(1)	94	1.2 acres	(1)	(1)
D-15	Big Game	35	.05 sq.mi.	(1)	(1)	692	.25 sq.mi.	(1)	(1)	1,546	.2 sq.mi.	(1)	(1)
	Small Game	1,241	.7 "	(2)	(2)(4)(2)	3,196	1.4 "	(2)	(1)(4)(1)	5,581	1.4 "	(2)	(1)(4)(1)
	Waterfowl	87	22.0 acres	(1)	(1)	176	23.0 acres	(1)	(1)	281	31.0 acres	(1)	(1)
D-16	Big Game	0	0	(4)	(2)	0	0	(3)	(2)	0	0	(3)	(2)
	Small Game	0	0	(2)	(2)(3)(1)	121	.2 sq.mi.	(2)	(2)(3)(1)	254	.1 sq.mi.	(2)	(2)(3)(1)
	Waterfowl	0	0	(1)	(1)	27	11.9 acres	(1)	(1)	62	13.7 acres	(1)	(1)
Sub-	Big Game	99	.15 sq.mi.	(2)	(1)	904	.35 sq.mi.	(2)	(1)	1,945	.3 sq.mi.	(2)	(1)
Region	Small Game	1,545	.8 "	(2)	(1)(4)(1)	4,029	1.7 "	(2)	(1)(4)(1)	6,999	1.7 "	(2)	(1)(4)(1)
D	Waterfowl	129	25.3 acres	(1)	(1)	269	36.8 acres	(1)	(1)	437	45.9 acres	(1)	(1)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance as listed in 3/ below.

3/ Includes small game,stocking, preservation of areas inhabited by rare and endangered species, and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance and (5) insignificant.

Table 0-34 (Continued) SUB-REGION E

		1980				2000				2020			
Basin	Wildlife Category	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other	Man-Day 1/ Needs	Access Needs	Habitat 2/ MGMT	MGMT 3/ Other
E-17	Big Game	0	0	(3)	(2)	3	.4 sq.mi.	(3)	(2)	803	1.0 sq.mi.	(3)	(2)
	Small Game	0	0	(2)	(2)(4)(2)	1,482	1.0 "	(2)	(2)(4)(2)	3,557	1.2 "	(2)	(2)(4)(2)
	Waterfowl	65	.2 acres	(2)	(3)	99	.65 acres	(2)	(3)	139	.75 acres	(2)	(3)
E-18	Big Game	0	0	(3)	(1)	0	0	(3)	(1)	124	.2 sq.mi.	(3)	(1)
	Small Game	212	.9 sq.mi.	(1)	(1)(3)(1)	495	.3 sq.mi.	(1)	(1)(3)(1)	1,035	.6 "	(1)	(1)(3)(1)
	Waterfowl	0	0	(1)	(1)	56	1.2 acres	(1)	(1)	122	8.8 acres	(1)	(1)
Sub-	Big Game	0	0	(3)	(2)	0	0	(3)	(2)	927	1.6 sq.mi.	(3)	(2)
Region	Small Game	4	.9 sq.mi.	(2)	(2)(3)(1)	1,977	1.3 sq.mi.	(2)	(2)(3)(1)	4,592	1.8 "	(2)	(2)(3)(1)
E	Waterfowl	60	.2 acres	(1)	(1)	155	1.9 acres	(1)	(1)	261	10.0 acres	(1)	(1)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance as listed in 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species, and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance and (5) insignificant.

Table 0-34 (Continued) SUB-REGION F

Basin	Wildlife Category	1980 Man-Day 1/ Needs	1980 Access Needs	1980 Habitat 2/ MGMT	1980 MGMT 3/ Other	2000 Man-Day 1/ Needs	2000 Access Needs	2000 Habitat 2/ MGMT	2000 MGMT 3/ Other	2020 Man-Day 1/ Needs	2020 Access Needs	2020 Habitat 2/ MGMT	2020 MGMT 3/ Other
F-19	Big Game	0	0	(3)	(2)	491	.55 sq.mi.	(3)	(2)	1,373	.2 sq.mi.	(3)	(2)
	Small Game	45	.2 sq.mi.	(2)	(3)(4)(1)	1,457	1.4 "	(2)	(3)(4)(1)	3,217	.6 "	(2)	(3)(4)(1)
	Waterfowl	70	2.0 acres	(1)	(1)	126	0	(1)	(1)	193	0	(1)	(1)
F-20	Big Game	32	.1 sq.mi.	(4)	(2)	89	.15 sq.mi.	(4)	(2)	181	.2 sq.mi.	(4)	(2)
	Small Game	0	0	(3)	(4)(4)(2)	122	1.0 "	(2)	(4)(4)(2)	473	.15 "	(2)	(4)(4)(2)
	Waterfowl	6	0	(3)	(2)	24	5.5 acres	(3)	(2)	42	6.1 acres	(3)	(2)
F-21	Big Game	164	.1 sq.mi.	(2)	(1)	270	.2 sq.mi.	(2)	(1)	521	.3 sq.mi.	(2)	(1)
	Small Game	0	0	(2)	(3)(4)(1)	570	.8 "	(2)	(3)(4)(1)	1,280	0	(2)	(3)(4)(1)
	Waterfowl	37	9.6 acres	(1)	(1)	60	0	(1)	(1)	87	0	(1)	(1)
Sub-Region F	Big Game	98	.2 sq.mi.	(3)	(1)	850	.9 sq.mi.	(3)	(1)	2,075	.7 sq.mi.	(3)	(1)
	Small Game	0	0	(2)	(3)(4)(1)	2,149	3.2 "	(2)	(3)(4)(1)	4,970	.75 "	(2)	(3)(4)(1)
	Waterfowl	113	11.6 acres	(1)	(1)	210	5.5 acres	(1)	(1)	322	6.1 acres	(1)	(1)

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance as listed in 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species, and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance and (5) insignificant.

Table 0-34 (Continued) Total NAR

Basin	Wildlife Category	1980 Man-Day 1/ Needs	1980 Access Needs	1980 Habitat 2/ MGMT	1980 MGMT 3/ Other	2000 Man-Day 1/ Needs	2000 Access Needs	2000 Habitat 2/ MGMT	2000 MGMT 3/ Other	2020 Man-Day 1/ Needs	2020 Access Needs	2020 Habitat 2/ MGMT	2020 MGMT 3/ Other
NAR	Big Game	0	1.0 sq.mi.			1,774	2.3 sq.mi.			5,923	3.7 sq.mi.		
	Small Game	1,872	3.2 "			11,312	10.0 "			22,792	7.8 "		
	Waterfowl	562	66.0 acres			1,121	61.7 acres			1,753	93.0 acres		

1/ That portion of total demand which cannot be accommodated. This occurs when the basic capability of the resource (i.e. including only the extent of habitat available as indicated by land use projection estimates) is converted to man-days and is less than total demand estimates.

2/ Increased habitat management necessary to upgrade quality of existing habitat. Rated 1 to 5 in order of importance as listed in 3/ below.

3/ Includes small game stocking, preservation of areas inhabited by rare and endangered species, and application of sustained yield harvest of resources. Each in turn rated from 1 to 5 in importance with (1) being extremely important, (2) important, (3) moderate, (4) minor significance and (5) insignificant.

Access Facilities. The complex patterns of private landownership coupled with the lack of definite information regarding the extent of total access available, preclude the possibility of identifying specific access needs. Nevertheless, some measure of the magnitude of present and expected future access needs in the NAR was necessary. The following methodology was utilized to derive the access needs.

To provide at least an estimate of the future need for access in relation to satisfaction of hunting demands, it was first necessary to estimate the current access available. This was accomplished through a proportionate relationship, assuming the total wildlife population in the basin was related to the habitat in the same proportion that the harvest was related to the accessibility of the resource. With the accessibility of the resource becoming the unknown quantity, it was then possible to provide an estimate of current access.

In order to predict future access needs, it was further assumed that the current access available would be related to future access needs in the same proportion that resource capability is related to the projected man-days demand. These assumptions provide the basis for predicting the access quantities needed for future satisfaction of demands upon wildlife resources. Although the indicated estimates of access needed are for satisfaction of hunting demands, they would meet the needs for non-consumptive recreation users.

The need for public hunting access is clear and undisputed. The type of access needed as well as the means of providing the access, however, can not be stated specifically in this report. The quantity of access required may be provided in conjunction with, or supplemented by the establishment of shooting preserves, additional public hunting areas obtained through lease or land acquisition, and owner-cooperative hunting programs. Additional research and studies concerning these problems, therefore, must be conducted in order to effectively plan for future uses of the wildlife resources.

An estimate of the quantity of access required to meet the needs of the hunter is given on Table 0-34. This Table shows incremental hunter access requirements in square miles and acres.

Legislation. As mentioned previously, in addition to access, new legislation must be incorporated into the augmented program. Hunting regulations should be developed to the extent that they provide the opportunity for maximum sustained yield of the resources. Legislation is listed on Table 0-34 under the category "Management: Other". A numerical ranking of estimated relative importance has been assigned to this category.

Management. The major objective of the wildlife plan is

to achieve a sufficient resource capability to meet the demand. The potential increase in the capability possible through augmentation of existing programs is shown in Table 0-35. The relatively small needs remaining may be satisfied by use of other devices. It is assumed that the potential capability of the augmented program will be realized. Additional devices required to satisfy remaining needs are set forth in the following paragraphs.

These additional devices include improving quality of the habitat; increased stocking of certain small-game species; transfer of demand to nearby basins; lowering the satisfaction level (i.e., decreasing consumptive use per hunter); or encouraging development of private shooting preserves.

Whenever habitat is acquired or improved in quality, access to permit full use should be provided if it is not already available.

Planning of the scope and intensity (or lack of intensity) characteristic of the NAR study calls for broad recommendations. Elements of the fish and wildlife plan, therefore, although viewed as the best measures from an overall aspect, will very likely prove impracticable in many instances when application in particular locations is considered. The fact that numerous other possible solutions do exist, however, as discussed in this Appendix, is reason to believe that the accomplishments anticipated from the plan can be realized, if not by one means, then by another.

The preservation, restoration, and development of waterfowl habitat, however, is basic to the future of waterfowl resources. Waterfowl are the farthest ranging of our game birds and from the very nature of their ecology require great acreages of marsh and open water associated with food-producing areas. These habitats also serve as important production, wintering, and resting areas.

Increased urban and industrial expansion threatens the very existence of these critical waterfowl areas and indicates the urgent need for expansion and acceleration of wetland acquisition and preservation programs.

Summary -- Plan for Consumptive Use of Wildlife

Augmented On-Going Programs

In summation, for each basin wherein needs for hunting opportunities were found to exist or were anticipated by any one of the benchmark years, it was determined that in most cases they could be met by augmenting on-going programs of acquiring access, managing habitat, and improving the legal framework for administration. Assuming that these measures were used to effect as much improvement as appeared possible, they would have to be supplemented by other measures (devices) in some instances or for certain categories of game.

TABLE 0-35

ANTICIPATED GAIN IN WILDLIFE RESOURCE CAPABILITY FROM AUGMENTATION OF ON-GOING STATE-FEDERAL PROGRAMS

(Figures in thousands)

		Capability in Man-days 1/			Potential Capability in Man-days 2/		
Basin	Game Class	1980	2000	2020	1980	2000	2020
A-1	Big game	220	248	220	354	354	354
	Small game	204	209	192	541	547	546
	Waterfowl	5	5	4	14	14	14*
A-2	Big game	267	267	251	347	347	321*
	Small game	367	357	322	817	787	735
	Waterfowl	32	30	29	66	63	57
A-3	Big game	197	197	197	300	300	300
	Small game	218	207	203	482	473	467
	Waterfowl	12	11	10	23	22	21*
A-4	Big game	210	210	210	293	293	293
	Small game	210	186	185	432	407	406
	Waterfowl	8	8	7	18	18	15*
A-5	Big game	200	200	200	299	299	299
	Small game	457	446	435	1,054	1,042	1.027
	Waterfowl	25	23	22	49	46	43
Sub-Region A	Big game	1,095	1,122	1,078	1,567	1 567	1,567
	Small game	1,456	1,405	1,337	3,326	3,256	3,181
	Waterfowl	82	77	72	168	163	150

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).

2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.

* Additional needs predicted.

Table 0-35 (Continued)

Basin	Game Class	Capability in Man-days 1/ 1980	2000	2020	Potential Capability in Man-days 2/ 1980	2000	2020
B-6	Big game	375	375	375	555	555	555*
	Small game	700	659	636	1,292	1,202	1,234
	Waterfowl	50	45	39	84	76	69
B-7	Big game	379	379	379	511	511*	511*
	Small game	548	506	482	1,370	1,277	1,200
	Waterfowl	31	28	26	70	64	58*
B-8	Big game	476	476	476	1,374	1,374	1,374
	Small game	832	736	671	3,077	2,704	2,730
	Waterfowl	30	26	24	91	84*	80*
B-9	Big game	60	60	60	167	167	133
	Small game	1,177	1,042	758	2,944	2,554	1,890*
	Waterfowl	149	139	125	456	408	368
B-10	Big game	39	39	39	125	125	125
	Small game	623	534	479	1,850	1,524	1,469
	Waterfowl	28	24	22	96	88	76
Sub-Region B	Big game	1,329	1,329	1,329	2,732	2,732	2,698
	Small game	3,880	3,477	3,026	10,533	9,261	8,523
	Waterfowl	288	262	236	797	720	651

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).

2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.

* Additional needs predicted.

Table 0-35 (Continued)

Basin	Game Class	Capability in Man-days 1/ 1980	2000	2020	Potential Capability in Man-days 2/ 1980	2000	2020
C-11	Big game	1,050	1,050	1,050	1,787	1,787	1,787
	Small game	1,780	1,619	1,508	3,338	3,051	3,115
	Waterfowl	24	22	20	34	32*	30*
C-12	Big game	503	546	503	990	1,073	990
	Small game	971	985	910	2,060	2,057	1,824
	Waterfowl	36	32	30	120	108*	100*
C-13	Big game	50	50	50	67	67	67
	Small game	857	770	693	1,744	1,619	1,485
	Waterfowl	95	82	77	219	191*	172*
Sub-Region C	Big game	1,603	1,646	1,603	2,844	2,927	2,844
	Small game	3,608	3,374	3,111	7,142	6,727	6,424
	Waterfowl	155	136	127	373	331*	302*

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).

2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.

* Additional needs predicted.

Table 0-35 (Continued)

Basin	Game Class	Capability in Man-days 1/ 1980	2000	2020	Potential Capability in Man-days 2/ 1980	2000	2020
D-14	Big game	192	160	109	500	417*	250*
	Small game	834	662	468	2,048	1,613	1,212*
	Waterfowl	43	40	34	120	112	104*
D-15	Big game	2,027	1,909	1,700	2,897	2,625	2,361*
	Small game	4,825	4,358	3,756	10,880	9,746	8,414*
	Waterfowl	192	176	158	448	403	365*
D-16	Big game	270	270	270	667	667	667
	Small game	485	452	435	1,353	1,275	1,220
	Waterfowl	90	81	72	168	152	136
Sub-Region D	Big game	2,489	2,339	2,079	4,064	3,709	3,278*
	Small game	6,144	5,472	4,659	14,281	12,634	10,846*
	Waterfowl	325	297	264	736	667	605*

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).

2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.

* Additional needs predicted.

Table 0-35 (Continued)

Basin	Game Class	Capability in Man-days 1/ 1980	2000	2020	Potential Capability in Man-days 2/ 1980	2000	2020
E-17	Big game	3,109	3,304	3,304	4,023	4,259	4,259
	Small game	5,756	5,447	5,051	10,046	9,444	8,798
	Waterfowl	51	46	41	192	175	160*
E-18	Big game	415	382	332	826	699	635
	Small game	1,348	1,153	995	2,662	2,222	1,869*
	Waterfowl	162	138	117	415	354	300
Sub-Region E	Big game	3,524	3,686	3,636	4,849	4,958	4,894
	Small game	7,104	6,600	6,046	12,708	11,666	10,667
	Waterfowl	213	184	158	607	529	460
F-19	Big game	1,457	1,457	1,292	2,715	2,715	2,460*
	Small game	2,895	2,710	2,471	5,900	5,361	4,962*
	Waterfowl	44	38	31	124	104*	88*
F-20	Big game	220	240	240	492	538	538
	Small game	953	914	852	1,776	1,681	1,591
	Waterfowl	32	26	22	84	72	60*
F-21	Big game	450	507	450	1,080	1,179	1,080
	Small game	2,050	1,842	1,738	3,918	3,539	3,370
	Waterfowl	33	28	23	74	64*	54*
Sub-Region F	Big game	2,127	2,204	1,982	4,287	4,432	4,078
	Small game	5,898	5,466	5,061	11,594	10,581	9,923*
	Waterfowl	109	92	76	282	240*	202*

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).
2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.
* Additional needs predicted.

Table 0-35 (Continued)

Basin	Game Class	Capability in Man-days 1/			Potential Capability in Man-days 2/		
		1980	2000	2020	1980	2000	2020
N.A.R.	Big game	12,166	12,326	11,707	20,343	20,325	19,359
Total	Small game	28,090	25,794	23,240	59,584	54,125	49,564
	Waterfowl	1,172	1,048	933	2,963	2,650	2,370*

1/ Based on estimates of habitat according to land use projections and correlated with resource population estimates (from Table 0-11).

2/ In addition to above includes hunter access, legislation (regulated hunting) and management measures as outlined in Table 0-34.

* Additional needs predicted.

Conservation of Habitat

Projection of resource capability took into account projection of future land use trends on wildlife habitat. These effects are shown in Table 0-10. In order to meet future needs for hunting opportunity in certain basins and sub-regions, these trends will have to be terminated. Conservation of habitat will need to be applied as follows:

Big Game. Needs over and above those which can be met by augmented on-going programs will occur in the following areas:

Sub-Region	Basin	Bench Mark Year	Plan of Action
A	2	2020	Maintain habitat at year 2000 level. (see Table 0-10)
D	14	2000	Maintain habitat at year 1980 level.
	15	2020	Maintain habitat at year 1980 level.
	All	2020	Maintain habitat at year 1980 level.
F	19	2020	Maintain habitat at year 2000 level.

Small Game. Needs not met by augmentation and the action to be taken are as follows:

Sub-Region	Basin	Bench Mark Year	Plan of Action
B	9	2020	Maintain habitat at year 2000 level.
D	14	2020	Maintain habitat at year 1980 level.
	15	2020	Maintain habitat at year 2000 level.
	All	2020	Maintain habitat at year 2000 level.
E	18	2020	Maintain habitat at year 2000 level.
F	19	2020	Maintain habitat at year 1980 level.
	All	2020	Maintain habitat at year 2000 level.

Waterfowl. Needs for waterfowl hunting opportunity over and above that which can be met by augmentation of on-going programs exist or will develop in all Sub-regions and in most basins by or before the year 2020. To meet these needs, it is urgent that plans for water and related land resources recognized the urgency of conserving waterfowl habitat so that there will be no less, at least, in 2020 than the amount projected for 1980. In some instances, even that will not be sufficient to meet 2020 needs. And if we look to generations beyond 2020, their needs very likely would indicate that the habitat level of 1965, as a minimum, be conserved.

Habitat Management - Big Game

Even with full augmentation of presently on-going programs and conservation of existing habitat, Sub-regions B and D will be unable to meet the needs of 2020 unless it is possible to increase the carrying capacity and productivity of that habitat. Perhaps another way of saying this is that habitat management will have to become more intensive over the next 50 years. Many techniques which are not now economically justified will be put into operation. Some of these have been duscussed under the heading Wildlife - Habitat Conservation and Development in Chapter 3, Problems and Possible Solutions. No doubt other techniques will be developed.

Habitat Creation - Waterfowl

Needs beyond the capability of the resource as improved by augmented on-going programs and conservation of existing habitat will begin to show up in several Sub-regions by the year 2000. Every opportunity to create additional waterfowl habitat, either through single-purpose projects or in conjunction with other developments of water and related land uses. This will be necessary even to maintain the existing amount of habitat, since there will undoubtedly be some loss of specific sites. Creation of additional waterfowl habitat is especially critical in Sub-region F where needs by the year 2000 will require an additional 41,000 acres if they are to be met.

Summary -- Plan for Rare and Endangered Species

General Discussion

Fish and wildlife species presently considered rare and/or endangered are identified in Table 0-2. This Table indicated where in the NAR these species are located, the possible cause for their decline, and in some cases the proposed protective measures. It is imperative that these proposals be considered for the conservation and development of fish and wildlife resources which are included in the category within the NAR.

All efforts to retain those species in danger of extinction as an integral part of the NAR's fauna must include the preservation

of their habitat. Additional measures for protection, while important, become meaningless without the retention of the habitat.

The species presently considered rare and/or endangered in the NAR include the following:

NAR General	Bog Turtle Southeastern pine grosbeak Southern Bald Eagle
NAR Coastal Areas	Ipswich sparrow Atlantic salmon Atlantic right whale Atlantic sturgeon
St. John and Penobscot Basins (A-1 and 2)	Blueback trout
Maine Coastal (A-5)	Sunapee Trout
Mass. & Rhode Island Coastal (B-9)	Beach Meadow Vole Block Island Meadow Vole
Hudson River Basin (C-12)	Short nose sturgeon
New Jersey Coastal (D-16)	Pine Barrens Tree frog
Susquehanna River Basin (E-17)	Maryland darter
Delmarva Peninsula (F-18)	Peninsula fox squirrel

On-going Programs - State and Federal

The effect of on-going programs is listed on Table 0-2 under Protective Measures Taken.

Augmented Programs - State and Federal

The effects of an augmented program to conserve existing endangered species are also shown on Table 0-2 under the heading Protective Measures Proposed.

The preservation of habitat and other proposed protective measures must be considered now. It will be too late if plans and implementation are delayed until the years 1980 or 2000. It should

also be noted that the species presently considered rare and endangered achieved this dubious distinction through the lack of concern for the species or its requirements. It is not unrealistic to assume that without continual surveillance and study of our fish and wildlife resources, we can be assured of an even longer list of rare and endangered species.

Summary - Plan for Non-Consumptive Use of Wildlife

Conservation and Development of Existing Resources

On-going Programs -- State and Federal. Generally, on-going Federal and State programs are not really being directed specifically towards providing for satisfaction of these demands. This is because finances for these agencies are provided primarily by sportsmen and, therefore, programs are directed toward meeting needs for hunting and sport-fishing opportunities. Indirectly, however, programs that provide habitat and management for game species also benefit non-game species. Because of this factor a large percentage of the non-consumptive use is provided for and supported on lands set aside for game species.

In addition to the multiple use made of the foregoing federal and state refuges and state game lands, many additional public and private lands provide opportunity for observation of fish and wildlife resources. These lands include public forests, parks, and nature areas. The Audubon Society and other similar conservation organizations provide lands with opportunity for wildlife observation. Additional non-consumptive use is provided for by private land holdings. Essentially all wildlife habitat provides opportunity for some degree of non-consumptive use.

In recognition of the multiple purpose non-consumptive use provided by the foregoing wildlife lands, it was assumed that the demand originating from all areas exclusive of Standard Metropolitan Statistical Areas of 1,000,000 population or more would be satisfied by on-going programs.

Augmented Programs - State and Federal. Generally stated, the augmented program would endeavor to satisfy the needs which were developed in Table 0-22. These needs, as previously mentioned, originate from SMSA's of one million or more population.

These needs exist primarily because of the problems of inadequate access and lack of facilities. The development of facilities to accommodate these needs was the selected solution to the problem. An approximation of the area in acres that these facilities would occupy was determined by applying to the man-days of needs the average peak load participation rates per acre of land for major wildlife refuges in the NAR. It was thought that the use made of refuge lands for non-consumptive recreation related to wildlife would

provide a measure of the pressure similar facilities would receive. On that basis sufficient quantities of land areas were recommended to accommodate the need. The estimated quantity of access required to meet the needs is listed on Table 0-36.

The above quantitites of land required for facility development are capable of being sub-divided to produce a non-consumptive-use facility. A general idea of the design and location of these facilities is desirable for preliminary planning purposes. A "typical" facility would consist of a 150-acre tract of land. It is designed to have an access road, a parking lot and a nature trail.

To estimate the cost of providing an urban nature and bird-watching facility, the following was used:

COST OF FACILITY

Item	Capital Cost
Gravel parking area (one acre, one foot thick)	$ 5,000
Access Road (1,000 ft. x 20 ft. - gravel)	2,000
Nature trail (10 ft. wide x 2 miles in length)	1,000
Land Clearing and Site Preparation	2,000
	$10,000 each area

To obtain the investment cost, the above figure must be added to the operation and maintenance and land costs. It appears that the land cost is going to be the determining factor in developing a favorable B:C ratio. Generally, these facilities are prohibitive. An unfavorable B:C ratio may result, therefore, unless the land is donated or multiple-purpose use can be made of these lands.

As mentioned above, these facilities should be located in or near the larger metropolitan areas. They should be distributed in the same distance relationship as that mentioned previously for other access development. This distribution pattern is based on day-trip usage. It would be preferable to locate these facilities along the coast in the vicinity of varying habitat types to attract the largest concentrations and varieties of migrating birds. Areas combining upland with salt and fresh-water marsh habitat would be especially valuable.

TABLE 0-36
ACCESS AREA REQUIRED FOR NON-CONSUMPTIVE USE OF WILDLIFE RESOURCES
(Figures in thousands/Increases are incremental)
(SMSA Origin)

1980

Basin in which need will occur	Boston (Area 9)		N.Y.-N.J. (Areas 13-14)		Philadelphia (Area 15)		Baltimore (Area 18)		Washington, D.C. (Area 19)		Total	
	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres
6	10	0.3									10	0.3
7	112	3.7									112	3.7
8	46	1.4									46	1.4
9	360	10.8									350	10.8
10	7	0.2									7	0.2
11												
12			313	9.7							313	9.7
13			1,092	33.3							1,092	33.3
14			813	23.5							813	23.5
15			60	1.8	875	26.6	2	0.1			937	28.5
16			147	4.7	118	3.4					265	8.1
17					53	1.6	14	0.4			67	2.0
18					13	0.4	159	4.5	140	4.4	312	9.3
19							24	0.7	499	14.8	523	15.5
20							3	0.1	25	0.6	28	0.7
21									8	0.2	8	0.2
Total	535	16	2,425	73	1,059	32	202	6	672	20	4,893	147

TABLE 0-36 (CONT.)

2000

Basin in which need will occur	Boston (Area 9)		N.Y.-N.J. (Areas 13-14)		Philadelphia (Area 15)		Baltimore (Area 18)		Washington, D.C. (Area 19)		Total	
	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres
6	16	0.3									16	0.3
7	188	5.3									188	5.3
8	72	2.2									72	2.2
9	552	17.6									552	17.6
10	10	0.2									10	0.2
11												
12			534	16							534	16.0
13			1,863	55							1,863	55.0
14			1,388	42							1,388	42.0
15			103	3	1,354	41.4	8	0.2			1,465	44.6
16			250	8	183	4.7					433	12.7
17					82	2.4	43	1.2			125	3.6
18					20	0.5	483	14.4	318	9.2	821	24.1
19							73	2.0	1,142	34.4	1,215	36.4
20							8	0.2	58	1.8	66	2.0
21									19	0.6	19	0.6
Total	838	26	4,138	124	1,639	49	615	18	1,537	46	8,767	263

2020

Basin in which need will occur	Boston (Area 9)		N.Y.-N.J. (Areas 13-14)		Philadelphia (Area 15)		Baltimore (Area 18)		Washington,D.C. (Area 19)		Total	
	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres	Man-days	Acres
6	19	0.6									19	0.6
7	229	6.9									229	6.9
8	87	2.7									87	2.7
9	675	20.2									675	20.2
10	13	0.4									13	0.4
11												
12			618	18							618	18.0
13			2,155	65							2,155	65.0
14			1,606	48							1,606	48.0
15			120	4	1,691	52.2	9	0.3			1,820	56.5
16			290	8	229	6.8					519	14.8
17					102	3.2	18	0.6			120	3.8
18					26	0.8	577	17.1	393	11.4	996	29.3
19							87	2.7	1,406	42.8	1,493	45.5
20							43	1.3	71	2.1	114	3.4
21									24	0.7	24	0.7
Total	1,023	31	4,789	143	2,048	63	734	22	1,894	57	10,488	316

CHAPTER 5. FISH AND WILDLIFE DEVELOPMENT COSTS

INTRODUCTION

An additional requirement of the NAR Study was to estimate a general order of magnitude of the costs that might be incurred for implementation of the devices required to supply the anticipated needs. Certain devices lend themselves to this type of analysis; however, others would require more detailed studies in order to obtain their cost approximations. A narrative statement is, therefore, used to explain these latter costs.

SPORTFISHING

Freshwater Fisheries - Resident Species

Creation and Development of Fishermen Access Facilities

The investment cost for these facilities is shown on Table 0-37.

Creation and Development of Additional Lake-Type Fisheries

It is anticipated that recreational fishing would be one of the multiple uses made of reservoirs constructed by other agencies, provided a satisfactory fishery was created. Costs for development of these facilities would, therefore, be developed by these construction agencies.

Improvement of Stream Fisheries

Low-flow Augmentation. It is anticipated that multiple use would be made of flow releases that improve the stream fishery. These flow releases would be provided by upstream storage in facilities constructed primarily by Federal construction agencies. These agencies will provide storage costs.

Water Quality Control. It is anticipated that established water quality standards will generally be adequate to provide for the requirements of the sports fishery. Improvement of fishery resources is, in fact, a significant source of benefits from meeting water quality standards. The costs required to meet water quality standards will be developed by the Office of Water Quality in the Environmental Protection Agency.

Other Plan Elements. Additional costs will incur for fish hatchery construction and stocking. Habitat improvement, fishery research, management, and law enforcement will also involve additional cash expenditures. More detailed studies will be required in order

TABLE 0-37
INVESTMENT COST FOR FISHERMEN-ACCESS FACILITIES
(Values in $millions/Increases are incremental)

	Cost of Anadromous Parking Facilities			Cost of Freshwater Parking Facilities			Cost of Saltwater Facilities								
							1980			2000			2020		
Basin	1980	2000	2020	1980	2000	2020	Cost of Parking Facili-ties	Addi-tional Land Cost	Fishing Pier Cost	Cost of Parking Facili-ties	Addi-tional Land Cost	Fishing Pier Cost	Cost of Parking Facili-ties	Addi-tional Land Cost	Fishing Pier Cost
1	.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	.29	.06	.07	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	.09	.04	.01	-	-	-	-	-	-	-	-	-	-	-	-
6	.11	.03	.04	.26	.70	1.03	.08	.06	-	.19	.17	-	.30	.24	-
7	.80	.21	.25	.39	.72	.90	-	-	-	-	-	-	-	-	-
8	.44	-	.07	1.53	1.44	1.82	-	-	-	-	-	-	-	-	-
9	.03	.01	.01	.82	1.37	1.65	1.34	.67	3.36	2.28	1.14	5.82	2.71	1.35	6.90
10	.02	.01	.01	.31	.79	.98	.21	.11	.54	.60	.31	1.53	.76	.38	1.94
11	-	-	-	.24	.38	.70	-	-	-	-	-	-	-	-	-
12	.22	.08	.08	.02	.22	.52	-	-	-	-	-	-	-	-	-
13	-	-	-	.20	.43	.58	3.92	6.95	7.13	6.55	11.69	11.96	7.53	13.39	13.70
14	.02	-	-	.14	.52	.65	-	-	-	-	-	-	-	-	-
15	.07	.08	.10	2.11	3.15	3.57	.10	.05	.24	.18	.09	.47	.24	.12	.62
16	.02	-	-	.04	.11	.11	1.34	.67	3.42	2.82	1.41	7.20	3.38	1.68	8.61
17	.30	.08	.10	1.64	2.80	3.55	-	-	-	-	-	-	-	-	-
18	-	-	-	2.53	1.25	1.33	.36	.18	.92	.84	.42	2.15	1.03	.51	2.33
19	.31	.14	.18	4.92	3.80	4.60	.88	.44	2.25	1.82	.91	4.35	2.24	1.12	5.72
20	-	.04	.06	.08	.25	.37	-	-	-	-	-	-	-	-	-
21	.30	.06	.11	.65	.63	.65	.56	.28	1.43	.76	.38	1.94	.94	.47	2.40
TOTALS	3.06	0.84	1.12	15.88	18.56	23.01	8.79	9.41	19.29	16.04	16.52	35.72	19.13	19.26	42.52

to estimate costs of these programs.

Freshwater Fisheries - Anadromous Species

Many of the costs discussed previously are equally applicable to the anadromous fishery. The investment costs for fishermen access facilities are included in table 0-37. The statements discussing low-flow augmentation, water quality control, and costs of other plan elements are equally applicable to this fishery. In addition to the foregoing costs, expenditures will be required to construct fish passage facilities at barriers that are presently preventing upstream migration. These costs are developed under the heading Fish Passage Facilities Recreational Fisheries - Anadromous in Chapter 4.

Saltwater Fisheries

Investment costs for land and related fishermen access facility development are also shown in Table 0-37. An estimate of the investment cost for constructing fishing piers is also included in that table.

COMMERCIAL FISHING

Additional studies will be required in order to estimate the magnitude of the investment costs involved for this program. This is because of the complex interactions involved. Pollution abatement costs to upgrade the water quality of our estuaries will be developed by the Water Quality Office of the Environmental Protection Agency. As mentioned previously, many of the problems that are limiting this fishery are caused by management and economic conditions. Legislation will be required in alleviating these conditions. Investment costs for fleet modernization, market development, and harvest technology will be provided by the private sector.

WILDLIFE

Additional studies will be required to estimate the investment costs for conserving and developing all categories of wildlife resources. These categories include game animals, rare and endangered species, and resources which are the basis for non-consumptive recreational activities. The range of options and resultant costs for land-related activities is great. Land can be purchased, secured by easements, or zoned. Combinations of these options are also possible. Generally speaking, quality land is required for wildlife conservation and development and to meet major needs, it should be located in close proximity to urban areas. The fee simple costs of such land can be considerable. Because of high land investment costs, it is very doubtful if single-purpose, wildlife-dependent

recreational developments based on the present willingness-to-pay concept can be economically justified; i.e., show a favorable B:C ratio. It would, therefore, appear that multiple or joint use would have to be planned for such land. Compatible land and water-related recreational uses could probably be accommodated on these lands. Multiple use could be made of private landholdings including agricultural lands providing suitable habitat. Multiple use for wildlife related recreational activities could be supported on the same lands that were required and developed in Appendix N, Visual and Cultural Environment. Multiple-purpose use made of such lands may enable a favorable B:C ratio to be achieved.

It was felt that any attempt to derive a cost estimate for public access requirements for land-related activities in such a broad study would not be meaningful. This would be especially true for hunting lands. The following examples will serve to illustrate this point. A road could provide access to vast areas of previously inaccessible land. An easement secured through private roadside property could likewise open vast areas behind the property line. A simple thing like knowing the landowner and gaining permission to use private lands can also gain access. To maximize the cost and assume that public access would have to be secured through fee simple purchase might also present an unrealistic figure. Any meaningful cost analysis is, therefore, considered beyond the scope of this report.

CHAPTER 6. FISH AND WILDLIFE BENEFITS

INTRODUCTION

Incorporation of the fish and wildlife plan will result in certain benefits both to society and to the ecosystem. Certain of these benefits can be quantified economically while others must be explained with a narrative statement. The benefits can be broken into three main types; recreational, commercial, and environmental.

RECREATIONAL BENEFITS

These benefits include sport fishing, hunting, and wildlife dependent non-consumptive uses. The following methodology was utilized to obtain an order of magnitude estimate of the anticipated benefits that could be obtained from incorporation of the suggested plan. The potential increase in man-days was abstracted from the appropriate tables.

The dollar values used to determine economic benefits in this report are derived from a range of values established for the use of all Federal agencies involved in water development programs.

These values are contained in a document titled, Evaluation Standards for Primary Outdoor Recreation Benefits, 1964, which has been issued as Supplement No. 1 to Senate Document No. 97, 87th Congress. The title of the latter is Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources, 1962.

An average value or net benefit of the composite populations that comprised the larger classification system was used in this study. It is realized, however, that certain individual populations would have a higher value and some a lower value.

The following recreational categories of fish and wildlife and their corresponding dollar benefits per man-day that were utilized in evaluating these benefit estimates are as follows:

Recreational Categories	Annual Dollar Value per Man-day
Hunting	
Big game	$4.00
Small game	$2.00
Waterfowl	$4.00
Fishing	
Freshwater	$2.00
Anadromous	$4.00
Saltwater	$3.00
Non-consumptive	$ .50

The benefits for the foregoing recreational categories are shown in Tables 0-38 to 0-40, inclusive.

COMMERCIAL BENEFITS

The economic benefits that can be obtained from meeting commercial fishery needs are shown on Table 0-41. The needs were abstracted from Table 0-20. The corresponding dollar values in Table 0-41 are expressed as dockside values, based on 1965 price levels. As mentioned previously, these dockside values are prices paid to fishermen and can be multiplied by a factor of about three to derive gross product value to the fishing industry. Although these are the estimated gross values at the landing they represent approximately the sum of the net values to the fishermen and the processor as well, plus wage payments to fishermen in certain cases.

ENVIRONMENTAL BENEFITS

In addition to having a value to the economy as indicated by the foregoing discussion, fish and wildlife resources have additional values which cannot be quantified in purely economic terms. Many of these values were discussed previously in the report and include aesthetic, educational, and recreational amenities derived from fish and wildlife resources. These values are important for our psychological well-being and as part of "the better life", but there are other values associated with fish and wildlife resources which are critically necessary to man's survival.

Lands and waters that are required for fish and wildlife habitat support plant growth. Plants are required to convert the energy of the sun to foods which all animals, including man, require. Stated simply, no plants - no animals. This statement is equally applicable concerning the oxygen supply provided by plants. Green

plants, in converting the energy of the sun to a food supply, give off oxygen as a by-product. Without this by-product, life as we know it could not exist.

Animals act as a check on overabundance of plant growths; they also help insure nutrient cycling which plants require for their growth. Going further, animal populations act as controls for other animal populations.

Very simply stated then, plants and animals are required to support our present life requirements by providing both the food we eat and the air we breathe. As human populations expand, the need for these requirements will also expand. The lands and water that we preserve for today will, therefore, be available for tomorrow's life requirements. Life and continued life is, therefore, the value of maintaining and preserving productive fish and wildlife habitat and its related environment.

TABLE O-38

POTENTIAL HUNTING BENEFITS

($Thousands/Increases are incremental)

Basin	Big Game 1980 Man-days	Big Game 1980 $ Value	Big Game 2000 Man-days	Big Game 2000 $ Value	Big Game 2020 Man-days	Big Game 2020 $ Value	Small Game 1980 Man-days	Small Game 1980 $ Value	Small Game 2000 Man-days	Small Game 2000 $ Value	Small Game 2020 Man-days	Small Game 2020 $ Value	Waterfowl 1980 Man-days	Waterfowl 1980 $ Value	Waterfowl 2000 Man-days	Waterfowl 2000 $ Value	Waterfowl 2020 Man-days	Waterfowl 2020 $ Value
1									17	34	54	108	7	28	2	8	3	12
2			30	120	66	264	27	54	71	142	109	218					4	16
3			25	100	38	152	57	114	56	112	57	114	6	24	4	16	4	16
4					12	48	24	48	60	120	49	98	8	32	2	8	4	13
5			33	132	41	164											4	16
6	54	216	99	396	126	504	2	4	204	408	229	458			7	28	18	72
7	56	224	109	436	129	516	63	126	196	392	205	410	19	76	16	64	17	68
8	135	540	160	640	194	776	245	490	382	764	408	816	54	216	27	108	29	116
9	1	4	14	56	17	68	256	512	425	850	623	1,246	32	128	53	212	64	256
10							97	194	297	594	297	594	17	68	17	68	17	68
11									217	431	425	850	10	40	7	28	9	36
12							10	20	142	284	272	544	57	228	24	96	25	103
13							149	298	270	540	287	574	72	288	49	196	45	180
14	179	716	110	440	320	1,280	316	632	396	792	452	904	45	180	21	84	28	112
15	35	140	657	2,628	854	3,416	1,241	2,432	1,955	3,910	2,385	4,770	87	348	89	356	105	420
16									121	242	133	266			27	108	35	140
17			3	12	800	3,200			1,482	2,964	2,075	4,150	65	260	34	133	40	160
18					124	496	212	424	283	566	540	1,080			56	224	66	264
19			491	1,964	882	3,528	45	90	1,412	2,824	1,760	3,520	70	280	56	224	67	268
20	32	128	57	228	92	368			122	244	351	702	6	24	18	72	18	72
21	164	656	106	424	251	1,004			570	1,140	710	1,420	37	148	23	92	27	108

TABLE 0-39

POTENTIAL SPORTFISHING BENEFITS

($Thousands/Increases are incremental)

	Anadromous						Freshwater						Saltwater					
	1980		2000		2020		1980		2000		2020		1980		2000		2020	
Basin	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value	Man-days	$ Value
1	25	100	4	16	5	20	-	-	-	-	-	-	-	-	-	-	-	-
2	205	820	35	140	45	180	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	63	252	25	100	29	116	-	-	-	-	-	-	-	-	-	-	-	-
6	75	300	18	72	23	92	185	370	508	1,016	754	1,508	51	153	144	432	211	633
7	574	2,296	150	600	179	716	280	560	523	1,046	666	1,332	-	-	-	-	-	-
8	324	1,296	-	-	49	196	1,116	2,232	1,044	2,088	1,339	2,678	-	-	-	-	-	-
9	22	88	5	20	6	24	581	1,162	957	1,914	1,162	2,324	911	2,733	1,551	4,653	1,824	5,472
10	8	32	3	12	3	12	231	462	597	1,194	732	1,464	148	414	413	1,239	512	1,536
11	-	-	-	-	-	-	156	312	251	502	477	954	-	-	-	-	-	-
12	155	620	51	204	60	240	2	4	141	282	349	698	-	-	-	-	-	-
13	-	-	-	-	-	-	137	274	296	592	386	772	1,879	5,637	3,159	9,477	3,633	10,899
14	6	24	1	4	1	1	94	188	349	698	443	886	-	-	-	-	-	-
15	41	164	56	224	67	268	1,499	2,998	2,240	4,480	2,761	5,522	63	189	123	369	163	489
16	1	4	1	4	1	4	17	34	72	144	84	168	909	2,727	1,913	5,739	2,272	6,816
17	210	840	57	228	70	280	1,197	2,394	2,042	4,084	2,632	5,264	-	-	-	-	-	-
18	-	-	-	-	-	-	1,803	3,606	884	1,768	951	1,902	246	738	570	1,710	695	2,085
19	208	832	98	392	119	476	3,338	6,676	2,577	5,154	3,117	6,234	590	1,770	1,235	3,705	1,522	4,566
20	-	-	25	100	35	140	41	82	163	326	280	560	-	-	-	-	-	-
21	206	824	47	188	87	348	464	928	443	886	464	928	376	1,128	518	1,554	643	1,929

TABLE O-40

POTENTIAL BENEFITS - NON-CONSUMPTIVE RECREATIONAL ACTIVITIES RELATED TO WILDLIFE

($Thousands/Increases are incremental)

	1980		2000		2020	
Basin	Man-Days	$ Value	Man-Days	$ Value	Man-Days	$ Value
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	10	5	16	8	19	10
7	112	56	188	94	229	115
8	46	23	72	36	87	44
9	360	180	552	276	675	338
10	7	4	10	5	13	7
11	-	-	-	-	-	-
12	313	157	534	267	618	309
13	1,092	546	1,863	932	2,155	1,077
14	813	407	1,388	694	1,606	803
15	937	469	1,465	733	1,820	910
16	265	133	433	217	519	260
17	67	34	125	63	120	60
18	312	156	821	411	996	498
19	523	262	1,215	607	1,493	746
20	28	14	66	33	114	57
21	8	4	19	10	24	12

TABLE O-41

POTENTIAL COMMERCIAL BENEFITS FROM ESTUARINE-DEPENDENT FISHERY RESOURCES

($Values in millions/Increases are incremental)

	1980		2000		2020	
Type of Resources	Million Pounds	$ Value	Million Pounds	$ Value	Million Pounds	$ Value
Finfish	125.0	3.5	277.2	7.8	442.6	12.4
Shellfish	15.2	4.3	101.6	28.9	228.0	64.8
Seaworms	--	--	.6	.5	1.0	.8

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ATTACHMENT 0-1

METHODOLOGY USED IN DETERMINING THE CURRENT STATUS AND USE OF FISH AND WILDLIFE RESOURCES IN THE NAR

HUMAN POPULATIONS

The determination of human populations for each basin was compiled on the basis of individual county representation. Basin boundary lines were compared with all counties and the percentage of the county within the basin was included in the total population estimate for that basin.

The county estimates for 1965, as indicated in the Rand McNally Commercial Atlas, were used to provide the present (1965) population base.

WILDLIFE RESOURCES

Hunters and Man-Days

Hunters (including non-residents) were determined from 1965 license sales and/or estimates of hunters in each county in a drainage area. Where specific information was lacking the statewide percent of the population that hunted was applied to individual drainage area populations.

Man-days of hunting were determined by multiplying (from the 1965 National Survey of Fishing and Hunting) the average number of days each hunter spends in pursuit of game resources by the estimated number of hunters. When specific information was available, it was used in place of the national average.

Wildlife Categories

1. Big Game: Deer, Bear, Moose

2. Small Game:

   Forest Game: Grouse, squirrel, varying hare, turkey

   Farm Game: Cottontail rabbit, quail, pheasant

3. Migratory Game: Waterfowl, dove, woodcock

4. Fur Animals: The status of individual species has not been determined. This category includes beaver, bob-cat, fisher, fox, marten, mink, muskrat, oppossum, otter, skunk and weasel.

Wildlife Populations

Wildlife populations were estimated by species breakdown in each drainage area. A variety of factors was considered in the development of these estimates. If a statewide population estimate for a particular species was available, it was distributed proportunately in each drainage area. The distribution of these totals was adjusted on the basis of supporting data which included harvests, extent and quality of ranges, stocking rates, recorded estimates, and other contributing information. Populations for other species were estimated using similar supporting information; however, more emphasis was placed on ratios and percentages to determine reasonable totals.

Wildlife Harvest

The harvest of individual species was determined primarily from estimates in Federal and State publications. In most instances this information was available on a county-wide basis. When the information was unavailable or fragmentary, the harvest was estimated on the basis of supporting data. This generally included proportional ratios for harvest estimates in other areas and states, extent and quality of ranges, hunters and hunter success, seasons and bag limits, historical estimates, and estimates based on the judgment of professional individuals familiar with the area.

Habitat

Habitat was estimated for individual species within big game, small game, and waterfowl categories. It was measured in square miles for all species except waterfowl. The waterfowl habitat was indicated in acres. The extent and quality of waterfowl habitat is more adequately described in terms of acres.

Generally, the amount of habitat indicated for each species was estimated, based on the amount of forest and agricultural lands present. However, this assumption was only designed to provide a reasonable indication of wildlife habitat. When specific information was available, it was used. If habitat information was deficient in certain areas, the general assumption of habitat quantity was applied and any fragmentary data available were used to temper the assumption.

Forest Lands

The quantity of game habitat (big game and forest game) was considered equal to the estimated forest lands in each basin.

Agricultural Lands

The amount of farm small game habitat was considered equal to the estimates of agricultural lands in each basin.

Other

Turkey. The resource was included in the small game category and habitat listed under forest habitat.

Dove. The resource was included under small game, but the habitat was assumed to overlap with big game and small game habitat. The habitat quantity was determined from information contained in the Bureau of Sport Fisheries and Wildlife reports on the status of mourning dove.

Waterfowl. Waterfowl habitat refers to lowlands covered with shallow and sometimes temporary or intermittent waters. Permanent waters of significant value to waterfowl are also included.

Woodcock. The resource was included under small game although the habitat overlaps big game and small game habitat. The habitat was estimated using land capability classes, subclass "w", as determined by the Soil Conservation Service in its NAR report of Land Drainage. There are eight land capability classes; classes I-IV are suitable for cultivation and other uses, classes V-VIII are not. Subclass "w" applied to any of these indicates excess water (from standpoint of agriculture), due to poor soil drainage, wetness, high water table, or over flow.

Man-Days Supply

This is defined as the use (in man-days) the resource can support presently. The following methods were used in its determination:

> Estimates of the extent and quality of habitat and corresponding harvests for each state were used to calculate the yield per square mile of range. These ratios were then applied to estimates of habitat in each drainage area. The numerations provided a reasonable indication of the harvests which could be supported under present conditions. These were then coverted to man-days supply figures, using the current hunter success and man-days per hunter as division and multiplication factors.

NON-CONSUMPTIVE USE

Information contained in the 1965 Survey of Outdoor Recreation was used as a basis for estimating minimum participation rates. The average man-days use per capita (12 and over) listed for activities related to wildlife photography, bird watching, and nature walks was utilized for determining nonconsumptive use. A minimum use

for non-consumptive activities in those Standard Metropolitan Statistical Areas with a population of one million or more people was also listed.

FISHERY RESOURCES

Fish Supply

Freshwater Fish

The supply of freshwater fish was related to the quantity and quality of the habitat. Using information for each Basin, a standing crop of game fish population was estimated and a percentage of these that could be harvested (average annual sustained yield) was calculated. Based on present satisfaction levels (1/2 pound cold-water fish - 1 lb. warm-water fish), the fishing pressure that could be sustained by the available supply was calculated. For certain river basins where information existed, i.e. tributaries of Chesapeake Bay, the Connecticut River and rivers of New Jersey, this information was used.

The potential supply was calculated using the Susquehanna and Connecticut Comprehensive River Basin Studies as comparisons for each basin in its respective region. The potential supply estimates are based upon the assumption that the present productive capacity of the lakes and streams will be preserved through maintenance of historical quantity and quality of water and that management measures to stock and improve the quality of the habitat will continue.

Various methods were used for evaluating the freshwater fishery habitat. Areas of standing surface water for each basin were taken from the Bureau of Outdoor Recreation's Lakes and Ponds Inventory (1968). The areas of flowing waters were computed by the following methods: In Sub-regions A and B, the stream mileages and acreages were either measured on maps or abstracted from "The Gold Book" (The Resources of the New England-New York Region). In Sub-regions C through E, a proportion was used comparing drainage area of Susquehanna River and its corresponding stream miles and acres to the unknown rivers. In Sub-region F, data of stream miles and corresponding acres listed in Fish and Wildlife Resources as Related to Water Pollution, October, 1968 were used.

Unproductive fishery habitat, insignificant intermittent tributary streams, private lakes having no public access, and water supply reservoirs prohibiting fishing were subtracted from total habitat.

For classifying habitat as to quality, various methods were used. The total productive fishery habitat in sub-region A was used for both lakes and streams. For Sub-region B, except for the Connecticut River Basin, habitat was class as Type 1 and II warm and

cold water based on state fishery publications and water quality classifications listed in "The Gold Book". In Sub-regions C through E and the Connecticut River, only Type I warm and cold-water was evaluated. Using the Susquehanna River as a base, a proportion was then compared with drainage areas to find additional unknowns (except in New jersey where State information was provided). For Sub-region F, the aforementioned published data listed in Fish and Wildlife Resources as Related to Water Pollution were used.

Anadromous Fish

The present supply was approximated from a literature survey. The estimate of supply was derived from spawning populations of fish which reproduce in the specific river being studied.

Saltwater Sport Fish

Estimates of saltwater sport fishing supplies were made using Stroud's method (SFI Bulletin No. 184, May 1967). This method assumes that the present five pounds a day harvest of saltwater fish in the NAR can be decreased to two pounds a day in the future and still provide acceptable success levels since it remains twice that of freshwater success. Using Bureau of Commercial Fisheries estimate of 50% increase in biological productivity, coupled with present use (fisherman days), we can calculate an approximation of future fishing pressure the present supply can accommodate. (Because of conflict between sport and commercial fishery uses of saltwater species, we could not assume present satisfaction levels would increase or remain constant due to need for increased commercial food fish).

Commercial Fish

The supply of estuarine-dependent finfish was considered capable of supporting and sustaining an additional fishing pressure of 50%. For estimating shellfish supplies a 100% increase was predicted. This is due to increased management practices, especially transplanting and depuration of shellfish stocks from presently condemned areas. Historic maximum harvests exceeded these estimates in the NAR.

The maximum available supply of commercial fish for the Chesapeake Bay Region (Sub-regions E and F) was derived from the Bureau of Sport Fisheries and Wildlife publication entitled Fish and Wildlife Resources as Related to Water Pollution.

PRESENT USE

Freshwater Fishermen

Based on State license sales (resident and nonresident), and estimating unlicensed fishermen, a fisherman total was derived.

The number of paid fishing-license holders was derived from the FWS News Release of April 12, 1967. The numbers of unlicensed fishermen were calculated from information provided in the National Survey of Fishing and Hunting, 1965. This publication also furnished information establishing the participation days based on the national average. The use was proportioned to the type of habitat (warm-water and cold-water) based on information supplied by the states for incorporation into the Bureau's study entitled National Survey of Needs for Hatchery Fish, 1968.

In general, it was assumed that for the purposes of this study the present supply was at least capable of generating present use. The habitat was classified according to its fishery management potential. Much of this habitat is a combination type of habitat, that is an integrade of the warmwater-coldwater classification. Such waters may be seasonally stocked with trout and at these times support a put-and-take fishery. Because of these stocking rates the supply is supporting the present use and certain water classifications are being utilized to their maximum capability.

In those cases where use exceeds the average annual sustained yield (supply), overfishing or overharvesting the resource occurred and fishermen were being satisfied with less than the national satisfaction level of one pound for warm-water or 1/2 pound for cold-water.

Anadromous Fisherman

To avoid any overlap or duplication in this study, anadromous fish were separated from saltwater fish. This was accomplished by defining an anadromous fish as one that spawns or reproduces in the specific river basin being studied. Since many anadromous species migrate and are caught in areas other than where they originated, (i.e. estuarine area) a use was shown for certain basins where insignificant natural reproduction occurred. This use was then assumed to equal the latent demand within the area. Anadromous runs of smelt were placed in the saltwater category.

Saltwater Sport Fisherman

The sport-fisherman use of the saltwater fishery resources was determined from basic data provided by the 1965 Salt-Water Angling Survey. Other contributing information used to provide estimates of sport fisherman use included: basic information provided by the National Survey of Fishing and Hunting, 1965, correlated with service area populations; an estimate of use based on the distribution of principal species appearing in the sport-fishermen harvest, correlated with the service area population in each state; and estimates of individuals with knowledge of the present use of these resources. The final determination of present use of these resources was adjusted to fit within the framework of the available basic information and estimation.

Commercial Fishery

The present (1965) harvest for each state within the NAR was obtained from the Bureau of Commercial Fisheries publication Fishery Statistics of the United States for 1965. For this study we are reporting only on estuarine-dependent species of marine life. The Bureau of Commercial Fisheries provided the list of commercial species that are considered estuarine-dependent (see Attachment O-2).

The dollar value of the commercial harvest is expressed as dockside value for both finfish and shellfish. These dollar values are prices paid to fishermen and can be multiplied by a factor of about three to derive gross product value to the fishing industry.

Although these figures represent gross value at the landing, they are considered to represent approximately the sum of the net values to the fishermen and to the processor as well, plus wage payments to fishermen in certain cases.

ATTACHMENT O-2
ESTUARINE-DEPENDENT COMMERCIAL SPECIES

COMMON NAMES	SCIENTIFIC NAMES
Finfish of Major Commercial Significance	
Menhaden	Brevoortia tyranus
Bluefish	Pomatomus saltatrix
Croaker (Atlantic)	Micropogon undulatus
Drum	Pogonias cromis
Redfish	Sciaenops ocellata
Eel (American)	Anguilla rostrata
Flounders	Pseudopleuronectes americanus, Paralichthyes dentata, Paralichthyes albigutta
Gizzard Shad	Dorosoma cepedianum
Hickory Shad	Alosa mediocris
Alewives	Alosa pseudoharengus, A. aestivalis
American Shad	Alosa sapidissima
Atlantic Salmon	Salmo salar
Striped Bass	Morone sexatilis
White Perch	Morone americanus
Scup, or Porgy	Calamus spp., Stenotomus spp.
Black Sea Bass	Centropristes philadelphicus
American Smelt	Osmerus mordax
Spot	Leiostomus xanthurus
Sturgeon	Acipenser spp.
Cobia (also called Ling or Lemonfish)	Rachycentrum canadum
Hake	Urophycis spp.
Pollock	Pollachius virens
Jacks	Caranx spp.
Harvestfish	Peprilus paru
Atlantic Butterfish	Poronotus triacanthus
Anchovy	Anchoa spp.
Kingfish	Menticirrhus spp.
Mullet	Mugil cephalus, Mugil curema
Finfish of Commercial Significanc as Baitfish	
Killifish	Fundulus spp., Cyprinodon variegatus
Silversides	Membras martinica, Menidia spp.

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Finfish of Marginal Commercial Significance

Gar	*Lepisosteus sp.*
Sea Robin	*Prinonotus sp.*
Northern Puffer	*Sphaeroides nephelus*

Crustacea of Commercial Significance

Blue Crab	*Callinectes sapidus*
American Lobster	*Homarus americanus*
Rock Crab	*Cancer spp.*
Shrimp	*Penaeus spp.*, *Xiphopenaeus spp.*

Mollusks of Commercial Significance

Surf Clams	*Spisula sp.*
Cherrystone (and Littleneck) Clams	*Mercenaria mercenaria*
Soft Shell Clams	*Mya arenaria*
Oysters	*Crassostrea virginia*
Periwinkles (Edible Snails)	*Littorina spp.*
Bay Scallops	*Aquipecton irradians*
Squid	*Lolligo sp.*

Bait Worms of Commercial Significance

Bloodworms	*Glycera sp.*
Sandworms	*Nereis sp.*

Reptiles of Commercial Significance

Terrapin Turtle	*Malademys sp.*

ATTACHMENT 0-3
CONCEPTS IN ESTIMATING DEMAND

The estimate of the future demand was developed by first comparing the relationship of present use of existing resources to present total population. Future numbers of users was assumed to vary directly with estimates of future population. Provided the abundance and qualities of the resources remain commensurate with what is required to satisfy present users, it was assumed that the percentage of the population using these resources would remain constant.

Future demand was calculated using population estimates for each basin for the bench years 1980, 2000, and 2020. In order to project the population figures through the year 2020, the 1960 population estimates were used as the starting point. The percent of population increase between 1960 and 1980, as determined from the Office of Business Economics projections1/, was applied to the base figures for each basin. A corresponding increase between 1980 and 2000 and between 2000 and 2020 was used to extend the projections for those periods.

Using the procedure described above, the following projections were obtained. The 1965 population within the North Atlantic Region was about 47.6 million. It is expected that by the year 1980, the population within the entire North Atlantic Region will number 55.9 million, 70.0 million by 2000, and by 2020, 86.8 million.

It is obvious that this growth will constitute a major influence upon fish and wildlife resources. In the first place, as the human population increases, there is a corresponding, although not necessarily directly proportional, increase in demand. On the other hand, as the human population increases -- encroaching upon rural areas, usurping and destroying fish and wildlife habitat -- there tends to be an accompanying decrease in the capability of fish and wildlife resources to meet human needs. Very simply, our effort in the North Atlantic Regional Study of water and related land resources is to point out means of conserving and developing these resources so as to most nearly meet projected human needs.

In this Study, a straight-line projection was employed, using the present hunter and fisherman totals expanded in accordance with the anticipated population increase. (Increase or decrease is assumed to be directly proportional to basin population projections).

License sales were considered as the best projective index

1/ Projections as of March 1968.

of future hunting and fishing demand. Most people who hunt or fish buy licenses, and the act of buying a license expresses a definite desire to hunt or fish. License sales represent a quantitative measure. The states keep accurate records of sales, records are readily available, and the amount of unlicensed participation is a known function of licensed participation.

For more specific information on the 1965 base used for obtaining numbers of hunters and fishermen see the previous section entitled Status of Fish and Wildlife Resources and Their Uses in the North Atlantic Region.

A projection is a forecast based on a number of assumptions, and as such, can be revised if future conditions should invalidate certain assumptions. To take full advantage of the flexible quality of projections, it is imperative to have a working knowledge of these assumptions and their effect on the developed methodology.

Many factors in the future may tend to alter the demand projections. Such factors include an altered population projection, effects of a decreased birth rate, national calamity, a significant decrease in the quantity and quality of the present habitat, and significant population shifts.

Consumptive uses of fish and wildlife resources can vary. If license fees were reduced or eliminated, a bigger demand might occur. Conversely, if a saltwater license were required, a decreased demand might follow.

Under present conditions, if Sunday hunting were permitted, an increased demand could be expected. Restrictive bag limits in certain instances have caused a lowered demand. Other factors adverse to hunting would be restrictive gun-control laws or an increase in the number of towns having ordinances forbidding discharge of firearms.

Many factors could alter commercial-fishery demand projections. An increase in protein food prices would probably increase demand for commercial fishery resources. Decreased importation of fishery resources into this country could increase domestic fishing operations. New methods of fishing, processing, and marketing may produce a more desirable product, increasing demand and creating new outlets. Fish protein concentrate offers an alternative possibility for solving protein deficiencies prevalent in many areas and its general acceptance would increase demand. Dietary trends towards fortified, low calorie, and cholesterol-free foods favor fish products, which are naturally constituted to fulfill these requirements.

Because of the time-distance factor that effects the hunting and fishing population -- the closer the supply to the demand the higher the participation rate. This increased participation -- popularity, if you will -- in itself has a positive influence on

demand.

Should it be impossible to bring supply into reasonable balance with demand, then fishermen and hunters may and probably will turn to alternative recreational activities. However, the desire to hunt and fish may well remain -- that is, there will exist a latent demand.

Although information from ongoing Type II comprehensive studies was utilized for various aspects of this Type I study, some discrepancies may appear in comparing the findings and conclusions. Some of these can be accounted for by use of differing population projections. In addition, although this study is regional in scope, we have for the present attempted to satisfy the demand where it originates. Thus, at this stage of planning, we have not transferred demand from one basin to another. This in effect means that we are presently attempting to satisfy from within a particular basin the demand of the basin residents plus the present proportion of nonresident sportsmen. If the demand is incapable of being satisfied within a basin, however, it is reasonable to assume that interbasin transfers will occur; this aspect will be considered as plan formulation progresses.

Another departure from these more detailed Type II studies was that the smallest unit used in the NAR analysis was a county. County units formed the basis for estimating resource supply. If the majority of the county's area was located in an NAR basin, it was evaluated as being entirely within that basin. Type II studies on the other hand, may subdivide basins into subbasins. Separate supply, demand, and need studies are accomplished for each area, resulting in figures that are not comparable to those of this study which considers the basin as a whole. This nonconformity, however, would not invalidate the findings herein as applied as a measure of regional needs and the nature and extent of means and measures to provide sufficient resources to meet those needs.

ATTACHMENT 0-4

SYNOPSIS OF FRAMEWORK PLAN FOR MEETING SPORT FISHERY NEEDS IN THE NAR

	AREAS																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FRESHWATER FISHERIES																					
Problems																					
Lack of Public Access	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Insufficient Cold-Water Streams							X	X	X	X	X		X	X	X				X	X	X
Insufficient Cold-Water Lakes								X	X	X			X	X		X					
Insufficient Warm-Water Lakes									X				X	X	X	X	X	X	X	X	X
Insufficient Warm-Water Streams										X			X					X	X	X	X
Solutions																					
Convert Demand										X								X	X	X	X
Transfer Demand													X					X	X		X
Reduce Satisfaction Level																			X		
Satisfied By On-Going Programs	X	X	X	X	X																
Utilize Tidal Freshwater Spp.																		X	X		
Fishermen Access						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pollution Abatement							X	X	X	X	X			X	X			X	X	X	X
Low-Flow Augmentation							X	X	X	X	X			X	X			X	X	X	X
Trout Stocking							X	X	X	X	X			X	X	X			X	X	X
Provide Access To Water Supply Reservoirs and Private Lakes								X	X	X			X	X	X	X	X	X	X	X	X
Impoundment Construction								X	X	X				X	X	X	X	X	X	X	X
ANADROMOUS FISHERIES																					
Problems																					
Barriers	X	X	X	X	X	X	X	X	X	X			X				X		X		
Pollution	X	X	X	X		X	X		X	X		X	X	X	X				X		X
Insufficient Spawning Habitat													X			X				X	
Lack of Public Access																		X			
Solutions																					
Reduce Satisfaction Level																					X
Minimum Flow Releases								X													
Satisfied by On-Going Programs																		X			
Transfer Demand	X		X	X		X			X	X			X								
Fishermen Access	X	X			X	X	X	X	X	X		X		X	X	X	X		X	X	X
Stocking	X	X			X	X	X	X	X	X						X	X		X		
Pollution Abatement	X	X				X	X	X	X	X		X		X	X		X		X	X	X
Fish Ways	X	X			X	X	X	X	X	X							X		X		
SALTWATER FISHERIES																					
Problems																					
Lack of Public Access					X	X			X	X			X		X	X		X	X	X	X
Pollution																			X		
Solutions																					
Satisfied by On-Going Programs					X															X	
Fishermen Access						X			X	X			X		X	X		X	X		X
Pollution Abatement																			X		X
Reduce Satisfaction Level																					X